Innovative Concepts for the Digital Euro:

A Lead User Study

&

Institute for Entrepreneurship & Innovation

Final Report

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Executive Summary

As our world increasingly becomes more digitalized, individuals and societies are simultaneously embracing the growing trend of cashless payment solutions. This transformative shift brings forth a multitude of promising opportunities alongside potential risks. One of the primary concerns lies in the diminishing influence of central banks in terms of monetary policy due to the growing prevalence of cashless payments and private bank money within the economy. Moreover, with the ongoing global developments and inflationary pressures, navigating, responding to, mitigating, and stabilizing a digital economy without a digital currency is projected to pose increasing challenges in the future (European Central Bank, 2023). Recognizing these global developments, the European Central Bank has initiated a two-year trial phase (European Central Bank, 2023) to explore the potential implementation of a central bank digital currency (CBDC). Currently, the national banks of the Euro Zone are actively engaged in comprehensive research with the goal to conceptualize the digital Euro, envisioning and developing innovative solutions that can enhance the market, meet future user needs and bring novel benefits to society (European Central Bank, 2023).

In order to ensure that the digital Euro meets user needs and to identify aspects through which the digital Euro can be implemented in an innovative manner, the following project utilized the framework of the Lead User Method. The following project consists of four Phases which revolve around identifying and interacting with so co-called Lead Users and Lead Experts. That is, individuals who possess an exceptionally high expertise within their field of competency and who ideally themselves are actively working and developing solutions within their markets. The ultimate goal was to invite these individuals to a panel discussion with experts from the Austrian National Bank and through establishing a creative space and atmosphere of novelty and invoking a comprehensive discussion with the aim to develop innovative solutions and implementation possibilities for the digital Euro.

During Phase I of the Lead User Light Method, our project team started by conducting primary desk research and immersing itself in existing literature to define the appropriate search field and areas that our research should be continued in. In Phase II, our primary objective was to systematically investigate and understand the significance and potential impact of various trends upon the future of the digital Euro. To accomplish this, we conducted numerous interviews, seeking to gather substantial knowledge about each of the identified trends. These interviews were vital in helping us evaluate the importance and robustness of each trend. During this process, we consistently pursued the task of identifying and refining trends that aligned with the project's objectives by engaging in discussions with a diverse range of experts and users.

Through these interactions, we gained insights and perspectives that allowed us to pinpoint the most relevant and suitable trends for our project. Based on 163 interviews three main trends, which provide the basis for the remaining project phases, were identified:

1. Lowering Privacy & Data Concerns
2. Universal Transmission
3. Integration Into Daily Life Habits

The first trend centers on often identified concerns of potential users regarding the central bank's management of sensitive data generated in every transaction. Hereby, addressing the specific privacy concerns of users is vital, as only a profound understanding of the issue can provide a proper solution. The solution to these concerns holds the key to the establishment and widespread acceptance of the digital Euro by users. The second trend concerns the implementation of the digital payment solution which will come with the digital Euro. To effectively serve its purpose, the digital Euro must possess the same functionalities as physical cash. Consequently, it is essential that the digital Euro exhibits the characteristics of transferability combined with the possibility of offline transactions. More specifically, the digital Euro should be easily transferable to any individual, irrespective of their location or time, without requiring additional infrastructure. This means that transactions should be feasible even when encountering someone, for example, spontaneously on the street. However, developing an innovative solution within this field is challenging and therefore one of the main priorities of the panel discussion. The third trend focuses on seamlessly integrating the digital Euro into users' everyday lives by developing a user-friendly interface that offers multi-functionality. Moreover, the aim is to create an interface that not only simplifies the user experience but also enhances the digital Euro's practicality and versatility.

In Phase III, our primary goal was to identify Lead Users and Lead Experts for the three specified trends. To achieve this, we employed a combination of techniques, such as pyramiding, content analysis, and broadcasting. Based on a systematic analysis to assess the contributions of the identified Lead Users and Experts via the Lead User Evaluation Matrix, the most promising individuals were invited to actively participate in a panel discussion to develop solutions and implementation possibilities for the digital Euro together with the experts from OeNB in Phase IV. Some key takeaways were that data & privacy concerns could be addressed by implementing Zero-Knowledge-Proofs, that driving adoption is essential and therefore incentivization strategies should be embraced. This can involve gamification techniques and subsidizing early adopters.

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1 Introduction

1.1 Project Partner

The Austrian National Bank (OeNB) is responsible for implementing monetary policy and ensuring the stability of Austria's financial system. In cooperation with the Eurosystem, a project was launched to establish the digital Euro as part of the ongoing digitization of the financial system. (Oesterreichische Nationalbank, 2022) To ensure that the digital Euro meets the needs of users, the OeNB is making use of the "Lead User Method." This method involves collaborating with a group of Lead Users and Lead Experts who are considered technology and product pioneers to make the digital Euro more user-friendly and effective. The objective is to create a Central Bank Digital Currency (CBDC) that satisfies the needs of a large population and is widely used.

The OeNB views the initiative to introduce the digital Euro as a possibility to strengthen the financial system. It is anticipated that the introduction of the digital Euro will lead to greater payment transaction efficacy and cost savings. (Oesterreichsiche Nationalbank, 2022) So while payments become more affordable and expedient, the digital Euro is also intended to be secure and protect user information. (European Central Bank, 2020) The Eurosystem is striving to ensure that the digital Euro can be effectively incorporated into the current financial system. Overall, the initiative to implement the digital Euro is a significant step towards a digital future for European finance.

1.2 Project Context

The global financial industry is currently characterized by a trend towards the decline of cash and strong research and development efforts towards CBDC (Bilotti & Botti, 2021). Leadership in this area has been taken by countries like China and Sweden in particular, which are already conducting extensive trials of such digital payment instruments. The opportunities offered by CBDCs are manifold, as they enable real-time transfers and the use of a digital currency - a key advantage over cash (Bank for International Settlements, 2018). In this context, the effort to launch the digital Euro is a significant step toward a digital future of European finance. However, there are still some challenges in this regard, in particular related to integrating the digital Euro into the existing financial system and ensuring transaction security. To successfully overcome these hurdles, the Oesterreichische Nationalbank (OeNB) is cooperating closely with other central banks and institutions in the Euro area (Summer & Weber, 2020).

Since 2021, the OeNB has been involved in the development of the digital Euro together with the Eurosystem. In this context, extensive research was conducted to gain an in-depth understanding of all stakeholders who could potentially come into contact with the digital Euro. In March 2022, the ECB

conducted the "Study on New Digital Payment Methods" to gain further insights. The study highlighted that respondents valued universal acceptance, contactless and instant peer-to-peer payments, integrated solutions, security, cost efficiency and financial privacy as desirable features of future digital payment methods. Merchants also emphasized the importance of high customer demand, low fees, fast transactions, technical reliability, good integration into their business processes, and security guarantees. The unbanked, underbanked and offline population showed a preference for user-friendly, secure, and free solutions with strong customer support.

This was followed in 2023 by another study titled "Study on Digital Wallet Features," which focused on gaining insights into the preferences of Eurozone citizens for digital payment systems. Participants were particularly open to budget management tools and peer-to-peer payments. Offline payments and QR code payments were seen as innovative, although concerns were raised about potential misuse. Conditional payments and the option for limited data in the transaction history received mixed reactions, while merchants viewed dashboard and pay-out management features positively. These existing studies focused on current trends and needs at the user front-end, consisting of the user interface and application use cases. The prioritised use cases for the first release of a digital Euro are person to person payments, payments in physical stores, e-commerce and government payments. (European Central Bank, 2022) That's why we focused on these use cases in our study.

The OeNB decided to further deepen its understanding of what is required for the digital Euro by also looking at future needs. In order to establish the digital Euro as an innovative and widely accepted means of payment in the European retail sector, the aim of this project is to identify the requirements of future European customers and to develop initial concepts for widely used payment methods from 2027 onward. The Lead User Method is a useful strategy for this purpose as it anticipates and identifies customer needs that need to be integrated into product development. This leads to innovations that are tailored to the specific needs of customers in the future and thus offer greater added value at the time of actual implementation. In addition, the involvement of Lead Users can accelerate market acceptance and strengthen the position of the digital Euro.

1.3 Lead User Method Overview

The Lead User Method is an innovative approach for identifying user needs and uncovering potential opportunities for product or service development (Von Hippel, 1986). This method aims to engage individuals or organizations, known as "Lead Users," who experience future needs ahead of the mass market and are motivated to find solutions to those needs (Von Hippel, 1986). By involving these users in the innovation process, organizations can leverage their insights and expertise to create products or services that better address the evolving market demands (Lüthje, Herstatt, & Von Hippel, 2005).

The Lead User Method can be broken down into four phases:

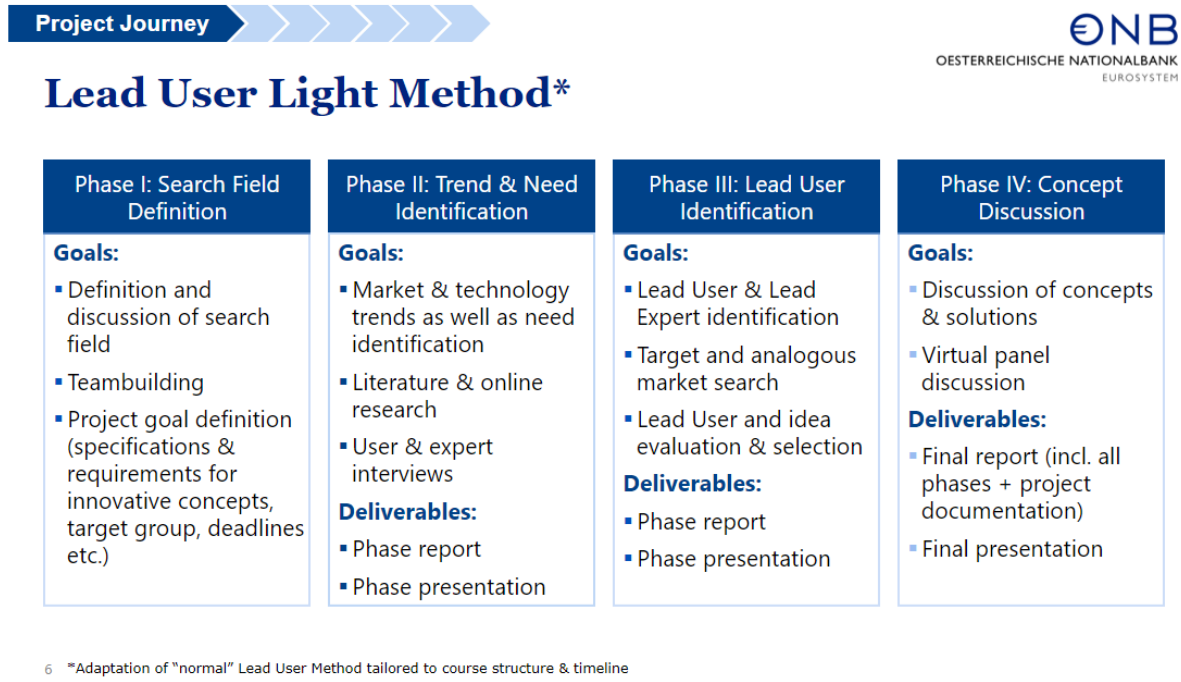

Figure 1: Phases of the Project
Internal Presentation (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

1. Identifying the target market and determining the search field: In this initial phase, the focus is on defining the area of interest or the specific market segment where innovation is desired (Oliveira & Von Hippel, 2011). For this project, the search field has been defined as *widely used innovative retail means of payments for the European public.*
2. Identifying trends and emerging needs: The second phase involves researching the market, analyzing trends, and identifying emerging needs within the specified search field (Hienerth & Lettl, 2011). Various research methods, including desk research and interviews with expert and users, are employed to gather relevant information.
3. Identifying Lead Users: Following the identification of trends and needs, the next step is to pinpoint potential Lead Users. These individuals are not simply early adopters of new technologies or solutions. They are a step ahead, often facing needs that will become common in the marketplace, but significantly earlier than the majority of the market. Due to their unique position, they can provide valuable insights into future needs, preferences, and potential issues before these become apparent in the mainstream market. This forward-looking perspective makes Lead Users exceptionally valuable in the innovation process. (Lüthje et al., 2005)

4. Developing innovative concepts: The final phase of the Lead User Method involves working closely with the identified Lead Users to co-create innovative product or service concepts that address the uncovered needs and trends (Hienerth et al., 2011). This collaborative process may involve brainstorming sessions, workshops, or other forms of co-creation to ensure the developed concepts are both innovative and aligned with the target users' requirements. *For the project at hand, a virtual panel discussion is organized to develop innovative concepts for customers, experts, financial institutions and governments.*

Knowledge of future trends and needs related to the digital Euro is vital. The identified tendencies have the potential to significantly affect design, functionality, and average user experience. For instance, if there is a clear trend towards greater security of digital transactions, then this development needs to be taken into consideration for the safety capabilities of the digital Euro. The Lead User Method can offer insightful information about how the digital Euro should be developed to satisfy the long-term preferences of impacted market sectors. This includes the knowledge gaps and benefits of the adoption of the digital euro in various markets, which could inspire the development of specific strategies for boosting its uptake. In the following phases of the project, the identified Lead Users will play a crucial role in co-creating innovative solutions for the digital Euro. Their insights can help to make sure that the digital Euro meets the evolving needs of its customers. In conclusion, the Lead User Method offers a user-centered technique to improve the digital Euro. By focusing on the needs of Lead Users, the development of the digital Euro will be supported to make the European CBDC an attractive, and modern digital payment solution that meets customer needs.

1.4 Search Field Definition

The search field for this Lead User Method study is "**Widely used innovative retail means of payments for the European public**". The goals that derive from this search field definition, are to identify needs of future European customers and to develop first concepts of widely used payment means which can be implemented by 2027 at the latest. In the project's first phase, the students aimed to define the research's initial scope and direction. This involved conducting preliminary investigations to understand the current payment solution landscape, as well as the digital Euro and its aspirations. Furthermore, this included studying existing literature, research papers, and several reports related to the digital Euro, in order to understand its potential use cases. This initial research can be found in the appendix (see appendix I.1). Additionally, key stakeholders such as central banks, financial institutions, consumers, businesses, and technology providers were considered. The different aspects and requirements of each stakeholder were

analyzed in this phase. Moreover, preliminary research questions, that guided the subsequent phases of the project, were formulated. These questions focused on all content related to potential Lead Users and how to identify them.

The search field aims to cover a broad range of payment methods, including traditional methods such as physical cash, credit cards and bank transfers, as well as highly innovative technologies and concepts like digital wallets, fintech-applications, and crypto assets. The target market, consisting of existing digital payment solutions and crypto assets, as well as analogous markets, like health-tech or transaction-based software solutions, were investigated.

The first roll-out of the digital Euro can be expected around the year 2027. Because of this, societal, technological, and other changes must be taken into consideration to align with the launch date. As 2027 is not too far in the future, no major changes of this sort are expected. However, they must always be considered as they could change at each step of the project phase.

2 Identification of Relevant Needs and Trends

2.1 Methodology

In order to gain insights into the trends and developments shaping the landscape of digital payments, we conducted interviews with a total of 48 experts in the fields of finance, blockchain, and crypto assets, and collected data from 115 users – 45 users were interviewed and 70 users answered an online survey consisting of the same questions as the interviews. The majority of the interviewees were contacted via email and phone, though a few were contacted via LinkedIn. During these interviews, most of which were conducted via phone calls, all participants were asked the same five main questions in order to gather their perspectives on the topic. The questions included: "What are, in your opinion, the most important trends that will influence digital payments and why?" and "What technological developments/trends do you think are potentially relevant in relation to digital payments?". Participants were also asked to provide information on prominent individuals or corporate entities involved in these technological advancements and to identify top experts in the field.

We intended to acquire a thorough grasp of the trends and advances influencing digital payments, as well as the main actors and specialists involved in this quickly developing industry, through these interviews. Additionally, the team used internet discussion boards like Reddit, derStandard, and Aviation Stack Exchange to learn about current developments in the target market and related industries, like data privacy in healthcare, government websites, and in-flight shopping. This strategy was less successful. Using the ProQuest database, the number of trends mentioned in the interviews and the information from desk

research were contrasted. The team was also able to locate other trend mentions in peer-reviewed academic articles by using the database's sophisticated search feature.

Hence, the following trends were mentioned in the aforementioned sources:

- Aging population
- Increasing spread of misinformation
- Decreasing inhibition to switch between providers
- DLT (Distributed Ledger Technologies)
- Geopolitical uncertainties more likely to disrupt marine internet cables
- Smart contracts
- Technical skills development (Digital divide)
- Increasing worry about liquidity
- Simplification
- Buy now, pay later
- Retailers hold less cash
- Increasing amount of phishing and similar scam / fraudulent attempts
- Biometric authentication
- Verification of identity
- Increasing carelessness from customers
- Money regulation (Legal aspects)
- Transparency
- Internet of Things
- Peer-to-peer payments are increasing
- Mistrust towards financial institutions
- Increasing political use of payment processing systems
- All in one payment solutions
- Reduction of transaction fees
- Digital wallets are becoming more capable
- Secure against forgery / security for money
- Digitalization
- Increasing rejection of transaction fees
- Inclusion of all people
- Untraceable transactions
- More user-friendly solutions (QR-Codes, biometric authentication)
- More privacy and data protection
- Instant payment
- Cross-border payments

In order to determine the relevance of these trends for our target market, we developed a formula that takes into account the number of mentions each trend received in academic literature as well as its prevalence in interviews with experts and users. The formula used to rank the trends is the following:

$$Relevance\ for\ Target\ Market = 0.5 \times n_e + 0.3 \times n_u + 0.2 \times n_l$$

$$n_e = amount\ of\ mentions\ by\ experts$$

$$n_u = amount\ of\ mentions\ by\ users$$

$$n_l = amount\ of\ mentions\ in\ academic\ literature$$

By assigning values to these factors and using a formula to weigh them appropriately, we were able to rank each trend objectively and systematically. 15 out of 33 trends were taken into closer consideration and will be discussed in the following section. The most important factor for our trend analysis were the expert interviews. Experts have profound knowledge and expertise in their field, which makes them comparatively more credible as a source of information. This is the reason for the factor weight of 0.5 in the formula, while the factor of user mentions has a weight of 0.3 as users have less insights and expertise in comparison to experts. The factor with the lowest weight (0.2) are mentions in academic literature, due to the fact that desk research primarily relies on existing information, which may limit the scope of innovation. It involves analyzing established trends, which may not account for emerging or disruptive ideas that have not yet been documented or widely recognized.

After ranking the trends by number of mentions, we classified them by project fit. Which trends we need to take into consideration are determined by the timeline and structure of our project and how much can we act upon them in the given setting and thus our search for Lead Users.

Based on these two assessments, we built a quantitative ranking system. We assigned to each of the 15 trends a bubble on the matrix with its size depending on the number of mentions across all sources and its position in the matrix on the rankings to X-axis and Y-axis (see Figure 2). Depending on the location of the bubble on the matrix, it was evaluated whether the trend is of great importance and should be further reviewed or not. Trends in quadrant 1 were considered for our project, while both quadrants numbered 2 require further review in order to evaluate whether they should be included. Lastly, trends in quadrant 3 are not included, because not only are they not high on project fit, but they are not relevant for the target market either.

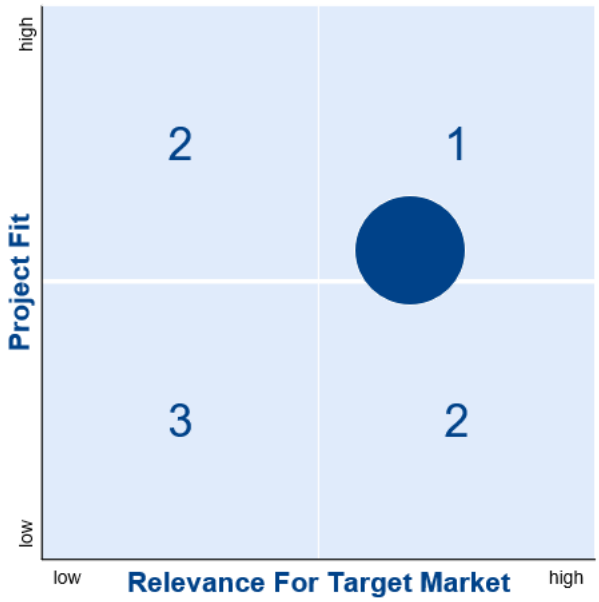

Figure 2: Quantitative Ranking System Matrix
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

After carefully assessing the trends, the most crucial ones were chosen based on this ranking. Additionally, some of the trends were consolidated and given new titles to better capture their essence. The 15 trends that were chosen as being the most important are:

1. Privacy & data concerns
2. Universal transmission
3. Integration (Into Daily Life Habits)
4. Cross-border transactions
5. Instant payment
6. Financial inclusion
7. Transaction fee aversion
8. Daily life digitalization of users (IoT)
9. Rising demand for digital wallets
10. Lack of trust in institutions
11. Peer-to-peer (P2P) solutions
12. Financial literacy
13. Avoidance of physical money
14. Capital preservation
15. Identity verification security

Each of the 15 mapped trends (see Figure 3) will be discussed further in chapter 2.2 Trends.

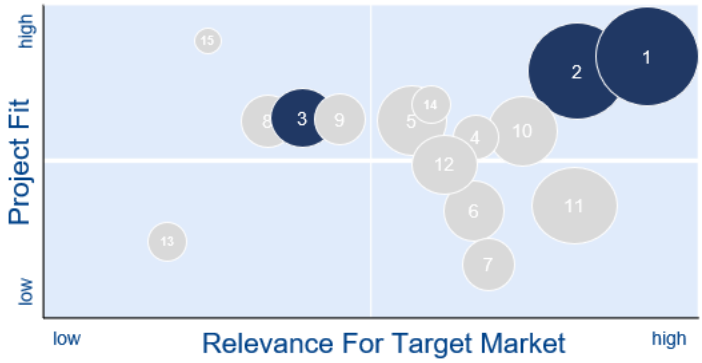

Figure 3: The 15 Trends Assigned to the Quantitative Ranking System Matrix
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

2.2 Top 3 Trends in Detail[1]

2.2.1 Privacy & Data Concerns

The trend Privacy & Data Concerns refers to the increased awareness of individuals about data breaches and cyberattacks during the last years and respective concerns regarding their privacy. The project team decided to focus more on user concerns regarding the processing of their data but did not exclude technological solutions to lowering these concerns. The root of this concern can be found in the increased collection of data by different large companies and the increased securities risks that accompany this activity. Following larger instances of security breaches of large databanks, which lead to the misuse and not consensual manipulation of users' data, such as in the Cambridge Analytica case, users have become cautious when sharing their information.

The European Union has tried to take action against such issues by implementing privacy regulations, such as the General Data Protection Regulation (GDPR) which aims to enhance user protection, these regulations are not universally applicable or lack enforcement (Suripeddi & Purandare, 2021). Therefore, users around the globe are still vulnerable to data breaches, cyberattacks or misuse of data collection. Lowering their concerns is of great importance for adopting a new digital payment method, such as the digital Euro.

This trend was mentioned 28 times by experts, 12 times by users and 23 times in academic literature.

[1] The top 3 trends form the basis for all remaining Lead User Method phases to come. That is, the identification of Lead Users (Phase III) as well as the idea and concept development (Phase IV) are solely focused on these 3 trends.

2.2.2 Universal Transmission[2]

Anyone, regardless of their location or the payment system they are using, should be able to receive and distribute money anywhere. This includes aspects such as offline payments. Hence, the Universal Transmission trend is aimed at addressing key unmet needs in the digital payment landscape, particularly for the digital Euro (Karalis et al., 2019a). P2P payments are an especially demanding and important part of this trend. They have to be easy to use and yet overcome many user and technical hurdles, as for example giving money for charity purposes to people on the street or functioning when both users use different types of devices or are offline.

One such need is the seamless transaction experience across locations and systems, which includes cross-border payments, regional payments, and transactions between different financial institutions (Zhao et al., 2021). By ensuring a smooth and frictionless payment process, the digital Euro can cater to all users in the Eurozone regardless the payment system they are using. (Panetta, 2023)

Another important unmet need is inclusion and accessibility (Burdea et al., 2014). The digital Euro should be designed to accommodate the needs of diverse populations, including those with varying levels of digital literacy and access to technology. By providing an inclusive and accessible platform, the digital Euro can enable all users to participate in the digital economy.

Offline transactions represent a further challenge that the Universal Transmission trend seeks to address (Karalis et al., 2019b). Users desire the ability to complete transactions even when both parties are offline or have limited access to the internet. By incorporating provisions for offline transactions, the digital Euro can ensure uninterrupted financial activities in various situations (Karalis et al., 2020). The incorporation of the digital Euro into current digital wallets that allow interoperability between payment systems is one example of a potential solution for these unmet demands for digital payment solutions (Karalis et al., 2019a). Additionally, when there is no internet connection, transactions could be completed using offline payment methods like near-field communication (NFC) or QR code-based payments (Karalis et al., 2019c).

The success of the Universal Transmission trend relies on several elements, such as the development of infrastructure, adherence to regulations, protection of privacy and security, and stakeholder cooperation (Baharudin et al., 2021). To safeguard users against fraud, theft, and other risks, the digital Euro should be built with strong encryption and authentication features (Zhao et al., 2021). Furthermore, it is required to abide to current financial regulations and should ideally be flexible enough to respond to potential changes in this regulatory environment (Burdea et al., 2014).

[2] Before renaming, this trend was called *One-For-All Payment Solution*. The digital Euro should be capable to function as a payment solution for a user in every common scenario - be it online shopping, reimbursing a friend for a favour or paying for groceries at the register of a supermarket.

Significant expenditures in digital infrastructure and payment system changes, such as boosting internet access and encouraging the use of digital payment technologies, may be required to facilitate Universal Transmission (Karalis et al., 2019). Finally, for the digital Euro to be implemented successfully, it will take close cooperation between financial institutions, governments, and technology providers to make sure that the system is developed and implemented in a way that satisfies the various demands of all users (Karalis et al., 2020).

This trend was mentioned 18 times by experts, 33 times by users and 6 times in academic literature.

2.2.3 Integration (Into Daily Life Habits)

This trend questions how the digital Euro should be integrated into already existing habits of daily life, for example commercial banking apps. The digital Euro should be well integrated into the already existing financial application landscape of today, as it should not replace already existing solutions, but rather complement and work with them. The Integration (Into Daily Life Habits) trend hence emphasizes the importance of universal compatibility and a convenient user experience to ensure a smooth and efficient integration process.

Universal compatibility is crucial in enabling users to manage their digital currency seamlessly across various financial applications and platforms, such as mobile banking apps, online payment gateways, and point-of-sale systems. (Veneris, Park, Long, & Puri, 2021) This compatibility not only attracts a broader user base but also facilitates adoption and encourages businesses and service providers to incorporate the digital Euro into their operations. Achieving universal compatibility requires collaboration and communication between stakeholders, including central banks, financial institutions, technology providers, and regulatory bodies, to address any technical, legal, or procedural challenges that may arise during integration.

A convenient user experience is equally important, as it appeals to both tech-savvy individuals and those less familiar with digital transactions. A user-friendly platform is essential for widespread acceptance and adoption of the digital Euro. (Walter Engert, 2017/16) Examples of such integration include popular banking applications, which could allow users to manage their digital currency alongside traditional banking services, and utility bill payment apps that streamline the process of paying for essential services. This implies for the digital Euro to work with APIs that allow other financial institutions and private companies to integrate it into their own or already existing solutions.

In order to make the digital Euro useful and user-friendly, continual refinement and adaptation to new technologies is also required. To succeed in the long run, it is critical to monitor and deal with any integration-related challenges that may arise.

In summary, the Integration (Into Daily Life Habits) trend highlights the need for universal compatibility and a convenient user experience to facilitate the seamless adoption of the digital Euro. This can be done through integration into various existing financial platforms and applications, making the digital Euro part of users' daily financial habits. Specifically, for the digital Euro to succeed, it must be effectively included into the financial system, which also includes other means of payment, as well as software programs, online banking and mobile applications. The design of these systems must support seamless transactions using both the digital Euro and other means of payments, such as wire transfers from checking accounts.

On a meta stage, this integration signifies the digital Euro's potential to grow to be an essential part of the economy. In that manner, it is not changing current economic infrastructures but augmenting them. It suggests a shift in the direction of digitalization in monetary transactions, promoting inclusivity, accessibility, and performance. Furthermore, it stresses the importance of collaborative efforts amongst diverse stakeholders, along with banks, monetary establishments, technology companies, and regulatory bodies, to enable easy and steady transactions with the digital Euro.

This trend was mentioned 7 times by experts, 16 times by users and could not be found in this form in academic literature.

2.3 Further Trends

2.3.1 Cross-Border Transactions

Due to an increased labor mobility and globalization, there has been an increase of cross-border transactions. The exact definition of this type of payment and the reasons for this are as follows.

Cross-border transactions refer to transfers of money across borders including the cross-border purchase of goods and services. Cross-border transactions have become of utmost importance in a globalized world where new technologies and worldwide communication and transportation have spurred international trade, foreign investments, and remittances. These payments include bank transfers, credit card payments and other payment methods, like digital wallets. (Chen et al., 2022)

Globalization and the subsequent increased movement of people, capital, and goods due to trade has substantially boosted the significance of such cross-border payments. The value of cross-border transactions is expected to undergo a significant increase, from nearly $150 trillion in 2017 to over $250 trillion by 2027, representing an increase of more than $100 trillion in just a decade. (Bank of England, 2023)

Cross-border payments can be divided into two categories: wholesale and retail. The wholesale form of cross-border transactions is initiated by institutions and can be, for example, borrowing, lending, exchanging different currencies among others. Retail cross-border transactions are those by regular people.

They can happen between people or between people and businesses and the number of these transactions has increased significantly in recent years.
This trend was mentioned 17 times by experts, 4 times by users and 11 times in academic literature.

2.3.2 Instant Payment

The Instant Payment trend is revolutionizing the financial sector by addressing several underlying unmet needs, such as eliminating time delays in transfers, enabling real-time change of ownership, and guaranteeing the receipt of funds. By addressing these needs, Instant Payment systems increase efficiency, convenience, and security in financial transactions. The US RTP network is one example of an real-time payment system. Notably, this network permits immediate transactions between member financial institutions. Another instance is the usage of digital wallets like PayPal, Venmo, and Zelle, which provide peer-to-peer transactions immediately. These technologies have revolutionized how people take care of their cash by speeding up and simplifying transactions.
Instant Payment systems are facilitated by advancements in technology and changes in regulations, enabling seamless integration with existing financial infrastructure. The growing adoption of digital currencies, such as crypto assets and stablecoins, is further propelling the possibilities for instant transactions. The financial environment is anticipated to change as the trend grows and established institutions are pushed to innovate and provide more competitive services in response to customer needs. Because of the need for better consumer convenience and efficiency, there has been a substantial change in the banking industry toward immediate payment solutions.
This trend was mentioned 5 times by experts, 5 times by users and 21 times in academic literature.

2.3.3 Financial Inclusion

Financial Inclusion aims to include all individuals and societies in a monetary system. All participants, regardless of their socioeconomic status, should have access to savings accounts, loans, insurance, and other financial instruments (World Bank, 2022). Another essential aspect of financial inclusion is promoting financial equality by ensuring equal access to financial products and services. (UN Capital Development Fund, 2023)
Despite its advantages, technological obstacles can impede financial inclusion. Not everyone has access to digital devices and technologies required to utilize digital financial services. Consequently, individuals in poorer or rural communities may lack access to these services (Barajas et al., 2020). Another point which needs to be taken into consideration is concerns of users of digital financial services about security and privacy of their personal data. Individuals may avoid digital financial services out of fear of private

information being leaked, thereby missing out on the benefits of digital finance. Complexity and lack of financial literacy are also obstacles to financial inclusion through digital financial services. Effective use of digital financial services frequently necessitates a higher level of financial literacy. People lacking the necessary skills and knowledge may have difficulty utilizing digital financial services, which may result in financial exclusion (Yadav et al., 2021). Digital technologies are complimented by the internet and digital devices, which may not be accessible or affordable for low incomes households or people who live in rural areas. The inability of the elderly or those with limited technical skills to use or comprehend digital financial services may lead to their exclusion from the digital financial system (Chandrasekhar, 2022). Lastly, there is the possibility of cybercrime and fraud, particularly for those with limited technical knowledge who may be more susceptible to fraud committed via digital channels (Sholikhah, 2022).

To summarize, to achieve financial inclusion it is essential to ensure that all individuals and communities have access to financial products and services and are included in a monetary system. However, a comprehensive strategy is required that considers the digital aspect and the security of transactions, as well as education and initiatives that promote financial literacy. The digital Euro initiative is a significant step in this direction, but it must be managed with care.

This trend was mentioned 10 times by experts, 1 time by users and 20 times in academic literature.

2.3.4 Transaction Fee Aversion

The trend of Transaction Fee Aversion is a common thread in both the digital currency and traditional financial systems. Customers are seeking ways to reduce the cost of financial transactions and avoid unnecessary fees. The main force behind the trend is the demand for more cost-effective alternatives. Users want to reduce the transaction costs associated with bank and financial institution services, such as ATM fees, overdraft fees, and wire transfers. In todays' world it is easier than ever for cost-sensitive consumers to compare the wide variety of financial services that allow them to reduce transaction costs. One example for this phenomenon are neo-banks where users are able to reduce their transaction costs when transferring money to another bank account or exchanging currencies.

Moreover, transaction fee aversion can also refer to the desire of small businesses to lower their costs. It is common for many SMEs to not have achieved economies of scale in the early stages of the company. Therefore, transportation and handling of cash and fees for non-cash payments are a major financial burden. Even if the transaction fees for small businesses are relatively low, they can still diminish the profitability of a business in cases of high volume of transactions. Many small businesses are put at disadvantage with regards to such fees also because their bargaining power is lower in comparison with larger businesses that could negotiate lower rates.

The Transaction Fee Aversion trend was mentioned by 16 experts, 35 users and 11 times in academic literature.

2.3.5 Daily Life Digitalization of Users (IoT)

The digitalization of consumers' daily lives is increasing. With the assistance of interconnected devices and digital solutions, financial transactions and activities can now be conducted rapidly and easily. The effects that digitalization brings increase accessibility and result in time and cost savings. Furthermore, it also expands access to financial services and the ability to offer customized financial services (World Bank, 2022). One of the primary advantages of digitalization is increased accessibility and convenience. Financial services get more accessible with digitalization, by using a mobile phone or computer one can be connected from any location. For both the user and the service provider, accessibility has led to time and cost savings (McWaters, 2015). For those who lacked access to traditional banking services previously, technology has also eased access to financial services. Thus, digital banking is an enabler towards a more inclusive financial system, providing access to individuals who previously encountered barriers (Manyika et al., 2016). Additionally, digitalization has the potential to improve the individualization of financial solutions. Using data analytics and machine learning, financial service providers are able to analyze individual data in order to provide customized financial solutions. A customized approach enables a more individualized financial experience, which ultimately increases user satisfaction (High, 2020). Automation of procedures is an additional benefit of digitalization. Interconnected smart devices allow processes to be automated. Automation reduces the likelihood of human error, and it saves time and money (EY, 2021).
The digitalization of users' daily lives has resulted in increased accessibility, convenience, time, and cost savings, expanded access to financial services, and the possibility of customized financial solutions. With the introduction of the digital Euro in the Eurozone, the advantages of digitization will be further enhanced, and users will gain access to financial services more quickly and easily.
This trend was mentioned 13 times by experts, 8 times by users and 9 times in academic literature.

2.3.6 Rising Demand for Digital Wallets

Digital wallets have been increasingly gaining popularity among smartphone users during the past few years. Thus, it is an important trend to consider for the digital Euro and its successful implementation. A digital wallet is a software application that enables users to store important and frequently used forms of payment or identification in one place. This includes drivers´ licenses, personal IDs, credit cards and many other similar functions. The users can easily choose from several functions by just opening the digital wallet

application. They are frequently organized in a neat manner and optimized for ease of use and reliable usage in everyday life. Both online and offline services can be used in this way.

In the context of the digital Euro and especially this project, digital wallets are an important aspect to consider, as they provide users with a seamless, easy, and secure way to make digital payments. It is likely that including the digital Euro into a digital wallet in one way or another, will have a significant effect on the acceptance and first usage of it as payment method. As the digital Euro will be used frequently in the everyday life of users, it is helpful if digital wallets are easy to use and are able to hold a large amount of data on the users' financial transactions.

Security is yet another unmet need traditional wallets do not provide on the same level. Digital wallets can be locked by pin, passwords, or biometrics, thus protecting from unauthorized access. Furthermore, users are less inclined to use solutions which are not included into digital wallets, as this requires interrupting an otherwise seamless paying experience. For example, the customer of a supermarket does not have to switch applications when paying with credit card and afterwards using a customer loyalty card to get a discount. It can all take place without leaving the digital wallet. This makes convenient payments an unmet need with credit cards. Digital wallets in the context of the digital Euro also should ideally consider other potential European projects, like a digital European identity card or driver's license, as these will likely have to supplement each other.

This trend was mentioned 7 times by experts, 2 times by users and 4 times in academic literature.

2.3.7 Lack of Trust in Institutions

The level of trust people have in their government is often used as a gauge of how well democracies are functioning and as an indicator of public administration's performance. During the COVID-19 pandemic in European countries, for instance, trust was found to be closely linked to compliance with measures intended to flatten the infection curve (Bargain & Aminjonov, 2020). The Trust Survey in November and December 2021 was conducted during a difficult period in most of the surveyed countries, which was nearly two years into the COVID-19 pandemic. While many OECD countries experienced an increase in trust in governments in 2020 at the beginning of the pandemic, known as the "rally around the flag" effect, by mid-2021 this trust had decreased in several countries (Brezzi et al., 2021).

Even though the digital Euro would offer many benefits like faster and cheaper transactions, greater financial inclusion and increased security, some experts and users have expressed their concerns regarding the potential for political interference. This shows that lack of trust in institutions might severely affect the adoption of the central bank digital currency from a user perspective. Several interviewed users expressed similar concerns about the potential for government control over their financial transactions. They voiced their worries that the digital Euro could enable governments and financial institutions to monitor their

financial transactions and limit their economic freedoms. Some even expressed fears of increased surveillance. In conclusion, the trend of Lack of Trust in Institutions highlights the need for clear and transparent institutional structures and processes to ensure that digital currencies are managed in a way that minimizes potential for political interference. In order for these concerns to be addressed, regulators have to ensure that the implementation of the digital Euro is clearly communicated to the Eurozone users.
This trend was mentioned 18 times by experts, 11 times by users and 7 times in academic literature.

2.3.8 P2P Solutions

Peer-to-peer payments, in short P2P, are transactions between people without the use of an intermediary. This is typically done through a digital platform or a mobile app. This has gained popularity because it allows personal transactions to, for example, split bills, make purchases from individuals or small businesses. In 2020, the market for P2P services had a valuation of $1,889.16 billion. This market is expected to grow with a CAGR of 17.3% from 2021 to 2030 to an estimated value of $9,097.06 billion (Allied Market Research, 2021).
A recent study indicates that 84% of U.S.-consumers have used P2P services. 44% of those even use it on a weekly basis. Popular providers for P2P services include Venmo, Paypal and Cashapp. The most popular among these providers is PayPal who first introduced this service (Davis, 2022). The increase of P2P payments has led to faster and cheaper ways to send and receive money via a simple click on your mobile device and without the need for cash. This has significantly increased convenience for users. However, the benefits have come hand in hand with several risks. Those include fraud and scams.
This trend was mentioned by 5 experts as well as 5 users and 21 times in academic journals.

2.3.9 Financial Literacy

To possess Financial Literacy means to be able to understand and manage personal finances, and the wish for an increase of this skill has been a growing trend in recent years. An important driving factor for this trend is the need for economic and social mobility. Financial Literacy is an important necessity to improve one’s financial situation and build wealth. This trend towards financial literacy was heavily influenced by the increased access to financial information through online resources, by the rise of self-employment, the gig economy, and the demographic shift that is currently taking place due to the retirement of the baby boomer generation.
An issue that could negatively impact Financial Literacy immensely is the “digital divide” which refers to the gap between individuals or communities who have access to digital technologies and those who do not. This gap can refer to access to the internet, computers, smartphones, and other digital devices. The digital

divide can also refer to differences in skills and knowledge in using digital technologies, like the digital Euro. The introduction of the digital Euro could, if this issue is not properly addressed, worsen the situation for many people and increase the “digital divide”. (A. Mooij, personal communication, 6. April, 2023)
This trend was mentioned by 4 experts and 6 users and could not be found in academic literature.

2.3.10 Avoidance of Physical Money

Avoidance of physical Money is an issue that is gaining importance according to our interviews in the contemporary financial world. As per the interviews, merchants favor digital payment methods over cash due to the cost of handling and transporting cash. It is undeniable that digital payments are gaining popularity over cash due to reduced handling costs, increased convenience, and simplified user experience. Additionally, the avoidance of physical currency for hygiene reasons is a growing concern for some users. By employing digital payment methods, merchants cannot only reduce costs associated with cash handling, but also address hygiene concerns.
A further advantage of eliminating cash currency mentioned in interviews is the resulting simplification of retail infrastructure. Processing cash necessitates a complex infrastructure consisting of specialized apparatus, employee training, and security. By adopting digital payment methods, retailers can streamline their infrastructure and reduce their maintenance expenses. The risk of larceny is another crucial factor mentioned for avoiding cash transactions. There is always a risk of theft when handling currency, necessitating additional security measures. Cash must be counted and packaged by merchants prior to being conveyed to the bank by a courier or an employee. These additional measures do not only increase the price but also the possibility of larceny. Moreover, carrying coins and bills in purses is frequently cumbersome, particularly when larger quantities are involved. The introduction of digital payment methods resolves these issues and improves retail efficiency. Overall, cash avoidance is a significant financial trend that is pursued by merchants and customers. The introduction of digital payment methods through the OeNB's initiative will assist in maximizing the benefits of digital payments and minimizing cash handling.
This trend was mentioned 4 times by experts, 1 time by users and 2 times in academic literature.

2.3.11 Capital Preservation

In the age of a digital financial world, the preservation of the nominal value of financial assets has certainly gained relevance. This is an issue that should also be taken into consideration upon the development of the digital Euro. As the digital Euro should provide a particularly trustworthy and stable form of digital currency, this is crucial for its adoption by the general population. Time has shown how quickly users get

impartial to a financial product when it does not provide them with stability and the guarantee that their money will be stored safely over longer periods of time.

Capital Preservation in this context is not to be confused with money losing value due to inflation but refers to the amount of money remaining the same regardless of the value of money due to other market factors. The easiest metaphor to visualize and make this more tangible, would be the example of a thousand Euros hidden under a mattress. Provided nobody breaks into the apartment, the amount of money will not change, even after long periods of time. The purchasing power of that money might lose or gain value due to inflation or deflation, but the amount of cash bills will remain exactly the same. It is also an easy-to understand concept that physical cash does not change its amount, thus even people with low financial literacy trust this system. With the digital Euro, people might become worried about their amount of money in their account changing over time, as online money accounts are often paired with some kind of monthly or yearly account fees that lower the total amount of money in the account over time. Digital money being programmed to expire is another concern, some people fear they will not be able to keep amounts of digital money, as the digital units themselves might be set to expire at a certain date, after a certain number of transactions, or after a certain time of usage.

As the preservation of capital is likely to not disappear any time soon from the concerns of potential future users of the digital Euro, this is an important trend that should be considered and also carefully communicated to the public, as to not make vague or misleading statement on this topic that might cause skepticism and thus endanger the roll-out.

This trend was mentioned 7 times by experts, 3 times by users and 2 times in academic literature.

2.3.12 Identity Verification Security

The trend of Identity Verification Security has become increasingly important in the world of digital currencies, smartphones, and mobile devices in particular, and as such is closely related to the digital Euro. For a central bank digital currency, safety should naturally not be something to compromise on. Especially with the rise of complex and frequent cyber-attacks on end users, the digital Euro will have to withstand many requirements in this field. There are two types of cyber-attacks that can be classified regarding this topic. One is cyber-attacks where cyber-criminals compromise the technical end of an application, without any involvement of the user, the second is cyber-attacks where the attacker uses approaches that require actions from the targeted user to work. An example for the latter would be something called a phishing attack. Here, the attacker sends out an email or any kind of message that convincingly deceives to be from a trusted source such as a friend or online shop. In reality however, the message is a virus that injects system instructions made by the attacker with the goal of harming or stealing from the user. Even for technically skilled people it is not always possible to differentiate a real from a scam message. As this project does not

go into detail on back-end technical specifications, focus should rather be placed on secure but yet easy to use measures, in regards that involve actions from the user.

Identity verification in general is a problem for digital transactions, as the true identity of a transaction partner is difficult to properly verify. With physical cash, this is not as much of an issue, as in the case of bank notes or coins handed to somebody, both parties can see the transaction partner in front of them in most cases. Even when taking out cash from an ATM, it is relatively easy to see what bank the ATM is placed at and so having a proof for the identity of said ATM. In the digital world users are normally not face to face with their transaction partner, this creates the need for users to be sure that they transmit the money with the entity they intend to interact with. This is of high importance also for receivers, as they also have the desire to be sure from whom they received a transaction.

This trend was mentioned 12 times by experts, 4 times by users and 1 time in academic literature.

3 Lead User Identification

3.1 Methodology

3.1.1 Lead User Sourcing

In order to identify Lead Users for the respective top 3 trends, the project group used multiple interpersonal but also online techniques. We relied mainly on pyramiding as well as to a lesser extent also on broadcasting and content analysis. A total of 81 experts were contacted and interviewed through the pyramiding technique and 20 forums relevant to the topic of digital currencies were accessed and analyzed.

Pyramiding via interviews proved most effective in the process of identification of Lead Users, especially in contrast to other techniques such as screening, which simply consists of simply bulk interviewing (Von Hippel et al., 2006). The pyramiding technique allows for a more focused and concise search that leads to higher quality and faster results (see appendix III.2). Our project team used this technique by initially approaching its direct personal and professional connections, and then engaging with interview partners' recommendations. In case of a lack of recommendations, team members proceeded to LinkedIn, on which they sought to identify experts in relevant fields and schedule brief evaluation meetings with these individuals. In order to reach further potential experts and Lead Users, at the end of each interview, the interviewer enquired about potential further connections the interviewee may have, that would be currently active in the target or analogous markets and have higher expertise, to ultimately reach the people who know best. This led to the number of recommendations an individual received also playing a significant role in the further evaluation and classification of our interview partners in the Lead User Evaluation Matrix (see next chapter). The more people recommended someone, the higher the expertise of that person and

hence the more valuable for the study. In other words: The more recommendations a given individual received from independent expert sources, the more this was regarded as a confirmation of the individual's position as a Lead User.

In addition to pyramiding, we also accessed online forums by using the techniques of broadcasting and content analysis. More specifically, content analysis is the observation of reactions to already existing online content (see Figure III.2.3 in appendix). Upon accessing different online forums, relevant posts were filtered and comments and interactions with these posts were regarded with more careful consideration. The authors with the most pertinent comments were then contacted and asked to engage in an interview. Similarly, broadcasting involved interaction with active online users on forums, however, rather than considering reactions to existing content, we created the content we wanted reactions to (see Figure III.2.2 in appendix). We applied these techniques in 20 different online forums (for full list, please refer to appendix III.8), of which eight could be defined as forums on Data and Privacy Concerns (Trend 1), three as relevant to Universal Transmission (Trend 2) and a further three for Integration Into Daily Life Habits (Trend 3). The reason for this uneven distribution of forum specialization was purposeful. Specifically, the number of Lead Users identified for Trend 1, that is, Data and Privacy Concerns, proved significantly lower than the other two selected trends. Hence, we strived to increase the number of interview partners in this area by accessing more online forums on the topic. Nevertheless, despite having accessed a large number of online forums, online searches proved less effective in identifying Lead Users, due to slow response times or unwillingness of users to take part in an interview.

This led to a final number of 58 interviews conducted, which allowed for the identification of nine Lead Users and one Lead Expert across our different key trends. Despite the digital Euro being a currency used solely in the Eurozone, the project group aimed to widen their search field to have a more global overview of how CBDCs are currently being developed in different countries. Due to the international nature of the

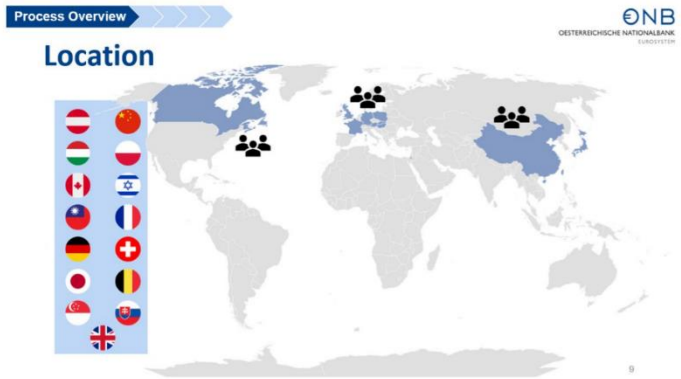

Figure 4: Geographical Location of Interview Partners
Internal Presentation (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

project team, we had access to diverse connections and the opportunity to access financial expertise even beyond Europe. The project group was able to widen its search to parts of Asia, the United Kingdom, and the USA (see Figure 5). The global width of the study decidedly allowed for a holistic approach and confirmed that the digitization of the financial sector is indeed omnipresent and rapidly developing. 20Hence, the diverse insights were of great relevance to our study.

3.1.2 Lead User Evaluation

Apart from gathering more potential contacts of relevance, the aim of each interview was not necessarily to identify a solution to the trends identified in previous phases but to decide whether the interview partner was a Lead User or not by considering the interviewees' professional experience, innovative activities and personality. The personality of the given individual also plays a significant role in how the interviewee was classified. Notably, a Lead User must be open to sharing their ideas and solutions to a given problem without financial remuneration, as the prospect of realizing the solution would be more important to them. This is why preserving the free-flowing nature of the conversation with our interviewees was important – it allowed for more clear inspection of the openness of the interview partner's character. Therefore, depending on the nature of the conversation, discussions ranged from 10 to 20 minutes.

The tool used for visualizing the evaluation of our interview partners was the Lead User Evaluation Matrix, developed by Eric von Hippel (Von Hippel, 1986). It is a framework that is widely used by firms to identify Lead Users for innovation purposes and classifies individuals according to two criteria: expected benefit and leading position, hence individuals' capacity to innovate and identify problems relevant to a wider market (for a more detailed description of the matrix see part III.1. in appendix). Upon evaluating our interviewees, we considered individuals in our target and also analogous markets, and to what extent they were active in innovating in their given specialized fields. Evidently, the individuals who scored highly in innovation and applicability to a large audience were those later examined in more detail. These individuals are also placed in figure 5 below, colour-coded as follows:

- Trend 1: Data & Privacy Concerns - orange
- Trend 2: Universal Transmission - yellow
- Trend 3: Integration Into Daily Life Habits - red

The vast majority of our Lead Users are classed into the upper-right quadrant due to high expected benefit and high leading position. It is also interesting to address the distribution of trend relevance. Notably, most of our identified Lead Users possessed relevant expertise in the area of Trend 3: Integration Into Daily Life Habits (eight individuals), while three individuals proposed relevant expertise for Trend 2: Universal Transmission, and finally two for Trend 1: Data and Privacy Concerns.

Finally, despite the geographical diversity of our conducted interviews, a certain homogeneity among our finally selected Lead Users is noticeable. Notably, they are all white males of a similar age. While we strived to diversify our interview profile and include a more diverse palette of genders, we focused primarily on the recommendations we received from our different interviewees, their professional expertise, and innovative activities. Were this study a representative survey, more emphasis would have been placed on the diversification of our interviewees. As this is not the goal and nature of a Lead User study, however, this does not pose an issue on the quality of the final recommendations and hence project outcomes.

3.2 Presentation of Identified Lead Users

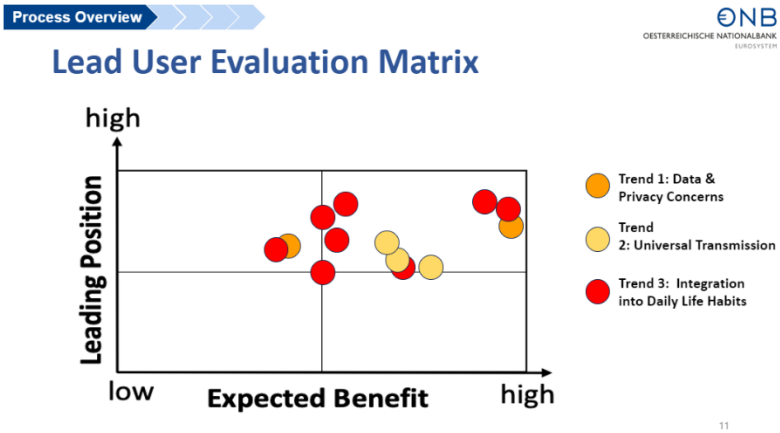

Figure 5: Lead User Evaluation Matrix used by the Project Group
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

Through our conducted interviews and with the help of our Lead User Evaluation tools, we identified a total of nine Lead Users and one further individual classed as a Lead Expert, who possessed particularly relevant expertise and is hence worth considering for the following phase of the project. Each Lead User will be presented in more detail according to the trend they demonstrate expertise in.

3.2.1 Lead Users in Trend 1: Data & Privacy Concerns

Martin Hergovič

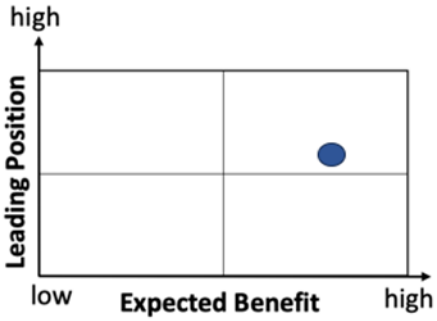

Figure 6: Classification of Martin Hergovič in the Lead User Matrix
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Martin Hergovič has been positioned with a high expected benefit and middling leading position (see Figure 6). He remains in the upper right quadrant; hence, he qualifies as a Lead User, despite his somewhat lower score on the y-axis variable. We distinguished him as a user in trends one and two, which will be justified in the following.

Martin has a background as a lawyer, which makes him more knowledgeable in the area of data protection and the legal aspect of how innovative measures to lower data concerns could be implemented. He is currently active as a legal strategy advisor specialized in cryptocurrencies at Sparring, which is an American legal advisory company specialized in tech companies and start-ups present in the US (NY), the EU (esp. in the Czech Republic and Slovakia), and the United Kingdom. This combination of legal and technological insights suggests promising output with regards to suggestions of how to further develop the digital Euro, especially due to his active contact with fast developing young companies. Furthermore, due to the company's international activity, this Lead User also has a broader outlook onto the development of digital payment and investment methods in different countries.

In addition to his experience in the field of cryptocurrencies and the tech industry, Martin has a degree in the regulation of crypto-assets and financial law, as well as a certificate from Princeton University on the topic of Bitcoin and Cryptocurrency Technologies. Moreover, while he is mostly active as a lawyer, Martin also spent some time working on technological solutions to improve blockchain technology, and also organizes the Prague Blockchain Week, which is a significant event in the industry where important persons of the industry, such as the founder of Ethereum will also be present. This shows a clear interest in the field, and a willingness to foster the rapid and successful development of the technology and is further underpinned by his openness to share his ideas and further qualifies him to be classed as a Lead User. While

the discussed Lead User is active in an analogous market – that of cryptocurrencies – the distance to the target market is not of great significance, due to the transferability of blockchain technology to other digital payment methods. Hence, he would some relevant and interesting comments with regard to CBDC technologies. It was also mentioned by multiple interviewees that blockchain technology would be the most promising technology to use for the development of a digital Euro, all the while emphasizing that Central Banks may eventually choose not to agree with this view.

3.2.2 Lead Users in Trend 2: Universal Transmission

Arne Nostitz-Rieneck

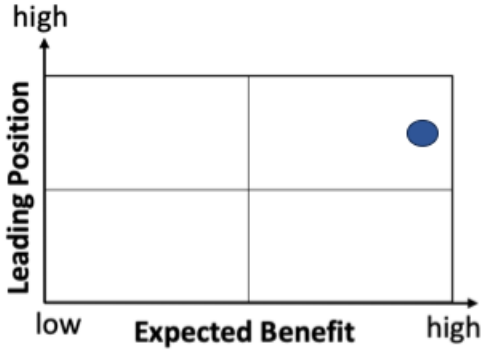

Figure 7: Classification of Arne Nostitz-Rieneck in the Lead User Matrix
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

Arne Nostitz-Rieneck is a highly classed Lead User. He shows high expected benefit as well as a high leading position (see Figure 7), the latter which is partly due to the high number of recommendations he received. Arne has been classified as an expert in trend 2.

What makes this candidate classed so highly is his experience and current activity as an entrepreneur in the fintech industry. Notably, he studied IT during his time at university and has been active in the Austrian entrepreneurship scene for over ten years, for instance, as a fellow at Austrian Startups. He is now developing and working full time at his own fintech company and solution, which is, in fact, a cashless donation system. Its aim is including members of society, who until now did not have access to digital payment methods, and improving efficiency in transactions, even when internet connection is not available. This solution shows many similarities to the aims of the digital Euro – which is to some extent increasing inclusivity – furthermore, tackles an issue that the development of the digital Euro is also facing. Notably, digital transmission without internet connection – that is Universal Transmission, as trend 2 is defined. Lastly, while Arne is developing his own solution in the target market, the factor that he is also an entrepreneur means that he needs to actively think outside the box and must tackle new situations. This skill that he has, thus, developed would therefore prove a dynamic driver in the development of innovative solutions.

David Stancel

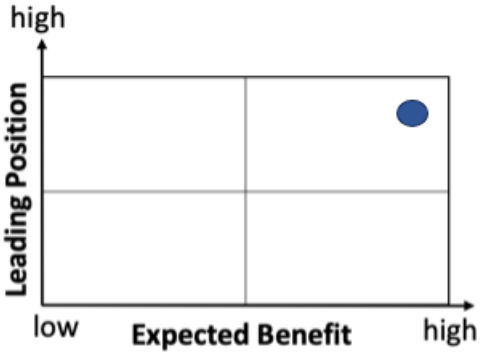

Figure 8: Classification of David Stancel in the Lead User Matrix
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

The currently discussed Lead User, David Stancel is one of the most highly classed individuals. He represents a position of high expected benefit and high leading position, while proposing expertise for our key trend 2 (see Figure 8).

David has an extensive background working in the crypto industry. Specifically, he held the position as CTO and CIO at Fumbi, a global cryptocurrency investing platform, while he is also an adjunct lecturer in cryptocurrencies at the University of Economics in Bratislava. Furthermore, he works a strategy advisor at Vacuumlabs, a fintech development service provider, and is the co-founder of Bitcoin Slovakia. Lastly, he published a book on the topic of digital payment methods. This extensive experience is proof of a clear interest in the topic of digital payments, investment opportunities and undoubtedly cryptocurrencies, and therefore ensures relevant potential contributions to the next phase of the project.

What also speaks in his favor is the high number of recommendations he received from independent Lead Experts, who themselves were highly classed in the Lead User Evaluation Matrix and was referred to as the "fastest" professional with regards to the relevant trends. In other words, he is in fact in leading position before the development of trends. Lastly, he is about to launch a company which will be focused also on connecting "normal" finance with crypto and he sees the digital Euro as a potential bridge.

Mihaly Orsós

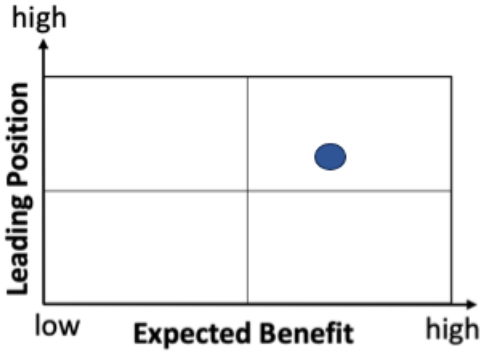

Figure 9: Classification of Mihály Orsós in the Lead User Matrix
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

Mihály Orsós occupies a position with relatively high leading position and expected benefit, which positions him in the top right Lead User quadrant (see Figure 9). Due to his area of expertise, he has been placed under trend 2, Universal Transmission.

Mihály has an interesting combination of experience, due to his experience working at different start-ups across diverse fields. He has a background in physics and business analytics, however, he has delved into coding and since then become an IT enthusiast. He has been active in the NFT sector while also working and has worked with multiple start-ups in founding and support functions. Due to his extensive involvement in the entrepreneurial landscape, he has encountered constantly evolving working practices and the emergence of numerous trends, occasionally even witnessing the start-up itself establish a trend.

He is currently working as a lecturer in coding at the Central European University (CEU) in Vienna, and is running his own crypto-currency community, Bull Ranks, based in Hungary. He follows the crypto industry on a global level to a great extent as well, and upon his interview, he immediately suggested multiple solutions to all three trends that we identified regarding the digital Euro. His rapid way of thinking and well-informed background regarding coding and the crypto industry would suggest a large bank of knowledge to implement for the development of the digital Euro.

3.2.3 Lead Users in Trend 3: Integration (Into Daily Life Habits)

Gergely Korpos

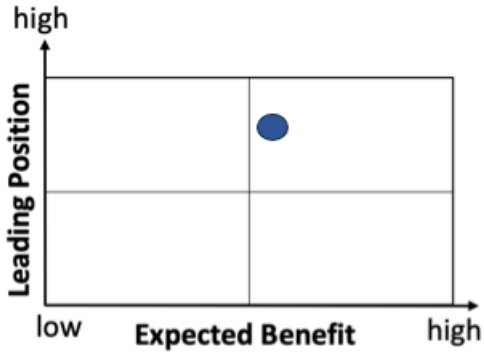

Figure 10: Classification of Gergely Korpos in the Lead User Matrix
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

The Lead User, Gergely Korpos, has been classed in the top right quadrant of the Lead User Evaluation Matrix (see Figure 10). He represents a position of high leading position and relatively high expected benefit. Due to his experience working in the fintech industry, he has been classified as a Lead User with relevant knowledge for identified trend number 3.

Gergely has an extensive background as an entrepreneur active in the fintech industry, which is particularly relevant to the current project, because in essence, the digital Euro is looking to be developed through an innovative fintech solution. As co-founder of the globally successful financial brokering company, BrokerChooser based in Malta with a Hungarian founding team, Gergely has been continuously exposed not only to the rapidly changing nature of the entrepreneurial lifestyle and working mode, but also to an industry that itself is very volatile. He has an astounding capability to generate ideas and new solutions on-the-spot, and while he himself is not an expert on CBDCs, upon understanding the concept of the digital Euro, was able to identify multiple instances where the digital Euro would fill a gap. Moreover, he developed a detailed suggestion as to the technological implementation of the digital Euro and provided ideas as to how the currency should be combined with another financial function to boost its use. While this suggestion may only be an initial one, which may not be implemented, this astounding ability to generate relevant ideas is decidedly conducive to a dynamic panel discussion in Phase IV of the project. Furthermore, as discussed previously, openness upon sharing ideas and thoughts is crucial in the evaluation of Lead Users, and Gergely demonstrated an impressive willingness to share his input on the subject, which also recommends him as a Lead User.

Ivan Muck

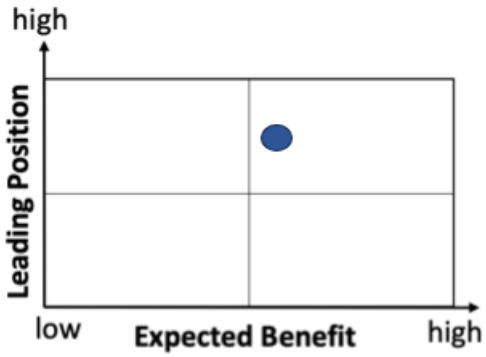

Figure 11: Classification of Ivan Muck in the Lead User Matrix
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The classification of Ivan Muck (see Figure 11) shows again a position in the top right quadrant of the matrix due to high leading position and relatively high expected benefit. His background and current working position make his expertise relevant for trend 3.

Ivan is a particularly relevant Lead User for the project, firstly, because of his experience as an entrepreneur, which, as has been detailed before, includes tackling new challenges constantly. This leads to the development of a set of skills for tackling new challenges effectively and innovatively. Secondly, Ivan is the co-founder and CEO of ff.next, a fintech company developing websites and apps externally for a large range of companies active in different areas. This means, in fact, that Ivan has daily professional practice in developing digital solutions, a skill that can be implemented and prove useful in the development of the digital Euro.

Furthermore, while the digital Euro itself is not an area where Ivan has extensive in-depth knowledge, he moderated a V4 (Poland, Hungary, Slovakia, Czech Republic) regional panel discussion on the topic of the development of CBDCs. This means that he is familiar with the topic of digital currencies and can therefore, suggest relevant solutions. However, he is still able to keep his external perspective and suggest out-of-the-box solutions. Finally, the outgoing and communicative nature of this Lead User is also important to mention, as it is particularly outstanding.

Lukáš Hatala

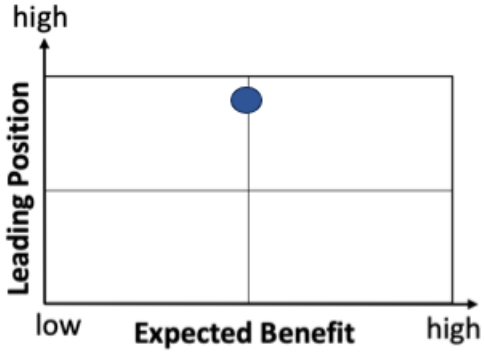

Figure 12: Classification of Lukáš Hatala in the Lead User Matrix
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The presently considered Lead User, Lukáš Hatala, has a position on the border between top right and top left quadrant in the Lead User Matrix (see Figure 12). That is, he is on the border between Lead User and Lead Expert. He possesses a particularly high leading position coupled with a middling expected benefit, which is partly due to his predominant professional activity as a consultant rather than as an entrepreneur.
Regarding his background, Lukáš is currently working as regional CTO for Eastern Europe at DXC Technology, an American technology consultancy. Furthermore, he is active as President and CEO of Neuromorphics Europe, an NGO working for the development of technology-focused companies. Finally, he is also the Director of International Affairs at Blockchain Slovakia.
He is very knowledgeable in the field of blockchain, crypto and digital identity, integration of technology as well as developing blockchain solutions for various markets and specializes in the development of blockchain systems used in energetics and in the stock market (industry use case).

Ondrej Sarnecký

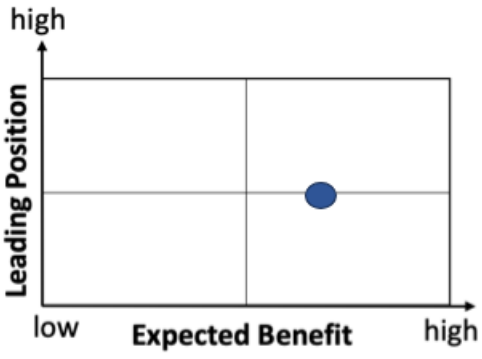

Figure 13: Classification of Ondrej Sarneckýin the Lead User Matrix
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Ondrej Sarnecký occupies a position on the border between top and bottom right quadrants, which places him between the Lead User and the user innovator category (see Figure 13). This is due to his position with high expected benefit, however, with middling leading position though.

Ondrej is the co-founder of the previously mentioned IT NGO, Neuromorphics Europe, and is currently active as the organization's CTO. Additionally to this position, he also works as a blockchain consultant at Ernst&Young, while also being part of the fifth cohort of Carbon 13, a British sustainable venture builder. This clear engagement with technology and start-ups suggests relevant skills, as well as the necessary knowledge base for a contribution in the panel discussion.

Tibor Bedő

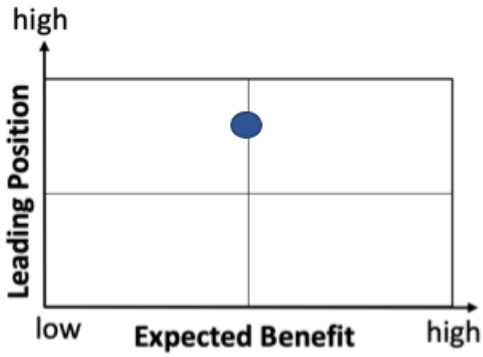

Figure 14: Classification of Tibor Bedő in the Lead User Matrix
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Tibor Bedő is positioned on the border between the top right and left quadrants, that is, between a Lead User and a Lead Expert, due to a high leading position, with relatively middling expected benefit (see Figure 14). Tibor is – as previously mentioned – Gergely's co-founder at Brokerchooser, where he is also currently CEO, and has a similarly prolific mind when it comes to generating ideas on-the-spot. Due to his experience as an entrepreneur, he faces new challenges daily and must tackle them in order to stay competitive within his industry (fintech), which in itself is quite volatile. During his interview, similarly to his co-founder Gergely, Tibor demonstrated his capacity to generate new ideas, by instantly proposing multiple use cases where the digital Euro would exclusively fill a need.

3.3 Presentation of the Identified Lead Expert

Finally, the only identified Lead Expert Tom Autischer is positioned on the border that divides Lead Experts and Lead Users (see Figure 15). He is indeed in a leading position due to his knowledge, experience, and expertise, but he has no personal benefit in the development of the digital Euro, which is the only reason why he is located in the upper left corner of our matrix.

Tom Autischer

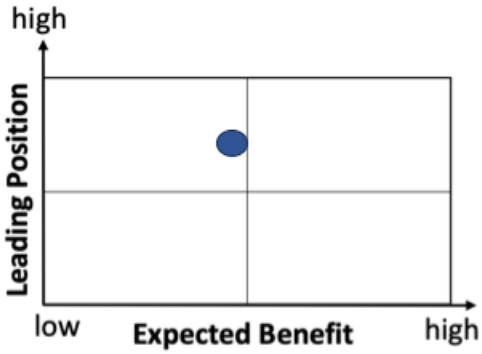

Figure 15: Classification of Tom Autischer in the Lead User Matrix
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Senior Manager at TPA Digital Advisory and founder of his own consulting firm, Tom Autischer not only has an entrepreneurial and innovative mindset (as he focuses also on disruptive innovation) applied to the IT industry, but thanks to his former experience in the betting industry, and as Head of Global Sales for an introducing broker, he is a perfect fit to identify ideas and solutions to lower trust barriers in the customers, and define the leverages to be used to make sure the target audience will adopt and use the digital Euro. Furthermore, his IT knowledge makes him a valuable resource to address the "Universal Transmissibility" trend, as during the interview he mentioned a viable solution to transfer data offline.

3.4 Recommended Lead Users for the Panel Discussion

After having evaluated all our interviews, the project team decided on six Lead Users, notably: Martin Hergovič, David Stancel, Mihály Orsós, Arne Nostitz-Rieneck, Gergely Korpos and Iván Muck. The detailed profile of each suggested Lead User has been indicated in previous sections; however, some broad points will be repeated to justify our decision in each case, listed according to trend.

3.4.1 Lead User Recommendation for Trend 1: Data & Privacy Concerns

Martin Hergovič was considered particularly relevant due to the combination of expertise in the legal field, as well as in technological developments. Hence, he not only provides expertise in one field, but a deeper understanding in two areas (technology and law) which can, thus, be combined to create a relevant suggestion for a solution during the consecutive Phase IV workshop.

On the other hand, another recommendation for trend 1, is **Tom Autischer**, who has all the requirements to actively and positively contribute to the identification of viable solution for the trend, thanks to his experience in the betting industry and due to his knowhow in sales, both aimed at lowering customers barriers and identify potential ways to increase the use of the digital Euro among the most skeptical.

3.4.2 Lead User Recommendation for Trend 2: Universal Transmission

David Stancel is one of our most highly recommended Lead Users, partly because of the high number of times he has been recommended by independent expert sources, and each recommendation emphasizes the innovativeness of his professional activities. Secondly, his activity as an entrepreneur and belief that CBDCs will be the way to bridge the gap between traditional payment methods and crypto currencies also recommend him for contributing to the project.

Mihály Orsós is one of our recommendations due to his experience working with start-ups and founding his own crypto-currency community. Furthermore, he demonstrates a high ability to understand and implement blockchain solutions in different areas.

Arne Nostitz-Rieneck occupies a very strong position in the Lead User Matrix. Furthermore, he is developing a very similar solution through his social start-up, Social Card. Therefore, some instances in the development of this start-up could also be transplanted into the development of the digital Euro.

3.4.3 Lead User Recommendation for Trend 3: Integration (Into Daily Life Habits)

Gergely Korpos was chosen due to his astounding ability to generate relevant solutions, as well as his expertise in the fintech area, and open nature. When weighing up whether to include this Lead User in our recommendations, we hesitated between Tibor and Gergely, as they had similar backgrounds, and shortly considered including both. An aspect that spoke for including both Lead Users in our list of recommendations was that Tibor and Gergely had experience working together, hence, would know how to effectively create unique solutions together. However, an argument that was brought against including both in our recommendations was that both individual's similar background would make the panel discussion very homogenous. Therefore, we decided upon recommending Gergely, due to his open communication and enthusiasm regarding the project.

Finally, **Ivan Muck** is one of our recommendations due to expertise in the fintech area, as well as his experience develop app and web solutions for companies externally. Furthermore, his insight into the world of CBDCs, due to his moderation of the V4 panel discussion also speaks for him.

3.5 Selection Process of Lead Users for the Virtual Panel Discussion

The concluding step in Phase III of the project was the selection of the Lead Users to invite to the final panel discussion. Following the presentation of the project team's result to the Steering Board, the recommendations were discussed along with the format of the discussion. While all recommended Lead Users were confirmed, the additional presence of the identified Lead Expert, Tom Autischer was agreed upon. It was a common consensus that an expert perspective would be interesting to involve in the formation of a solution during the panel discussion.

4 Panel Discussion

4.1 Methodology

The panel discussion serves as the final stage of the Lead User project for the digital Euro. Its primary objective is to foster collaboration among selected Lead Users, the Lead Expert, and representatives from OeNB to develop innovative concepts. The discussion revolves around the three most important trends for the digital Euro: Privacy & Data Concerns, Universal Transmission, and Integration (Into Daily Life Habits). Participants engage in brainstorming sessions, sharing ideas, and proposing novel ideas and concepts that are crucial for the successful adoption of the digital Euro by users within the Eurozone.

To the online panel discussion, a total of ten Lead Experts and Lead Users have been invited, specifically Martin Hergovič, Gergely Korpos, Ivan Muck, Mihaly Orsos, David Stancel, Arne Nostitz-Rieneck, Ondrej Sarnecky, Tom Autischer and Lukáš Hatala. Of these, Martin Hergovič, Tom Autischer, Arne Nostitz-Rieneck, Ivan Muck and Gergely Korpos accepted the invitation and, together with Vinzenz Treytl, they joined the panel discussion to share both their knowledge and expertise.

Other than the Lead Users and Lead Expert, it is important to mention that representatives of the Austrian National Bank joined in the panel discussion and participated actively in the breakout room sessions. Specifically, the OeNB members that participated have been Erik Pipal, Marco Aschenwald and Hannes Hermanky. Moreover, participants from the Austrian Blockchain Center (ABC) joined, namely Vinzenz Treytl and Alexander Neulinger. Vinzenz contributed as active panelist, sharing his expertise on the Universal Transmission trend. He is Senior Researcher at "ABC Research" and contributed in-depth knowledge about the digital Euro and blockchain-based payment methods. Alexander, on the other hand, supported the breakout sessions as moderator. To conclude, students who worked on the project and built

significant expertise themselves joined the panel, while others supported as co-moderators for the lecturers Melina Mazzucato and Tina Marie Monelyon representing the E&I Institute. The active participants of the panel discussion have been separated into three sub-teams as per the three trends (see Figure 16).

Figure 16: Participants Distribution
Internal Presentation (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

The discussion started with a brief overview of the stages of the project, the status quo and goal of the discussion. It consisted of two breakout sessions per trend team. The three teams discussed their individual trends – Data & Privacy Concerns, Universal Transmission and Integration (Into Daily Life Habits) – respectively in two stages (see Figure 17 for detailed agenda).

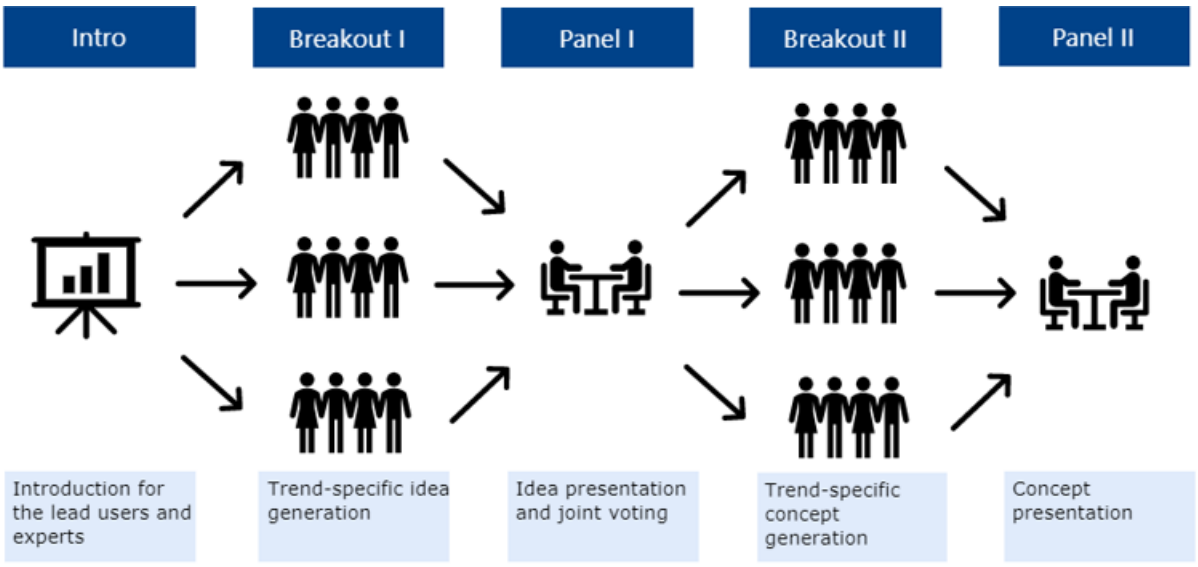

Figure 17: Panel Discussion Agenda
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

In the first breakout session, the emphasis was on brainstorming ideas without initially evaluating their feasibility or effectiveness in addressing the trends. Subsequently, each team presented between five to seven ideas in the first panel round, where all participants had the opportunity to rate them on a scale of 1 to 5[3]. The three ideas with the highest scores were selected for further exploration and development during the second breakout session. The purpose of the second breakout session was to delve deeper into the top three ideas for each trend and draft first potentially viable solutions. During this session, the developed concepts were thoroughly evaluated, considering various constraints and factors that would affect their implementation. Throughout the discussion, the methodology aimed to encourage creative thinking and generate a wide range of ideas. By initially exploring all possibilities and then focusing on the most promising concepts, the discussion fostered a comprehensive and evaluative approach to finding solutions for each trend.

4.2 Developed Ideas and Concepts

A total of ten concepts were developed during the panel discussion (for overview see Figure 18), each of which will be detailed in the following.

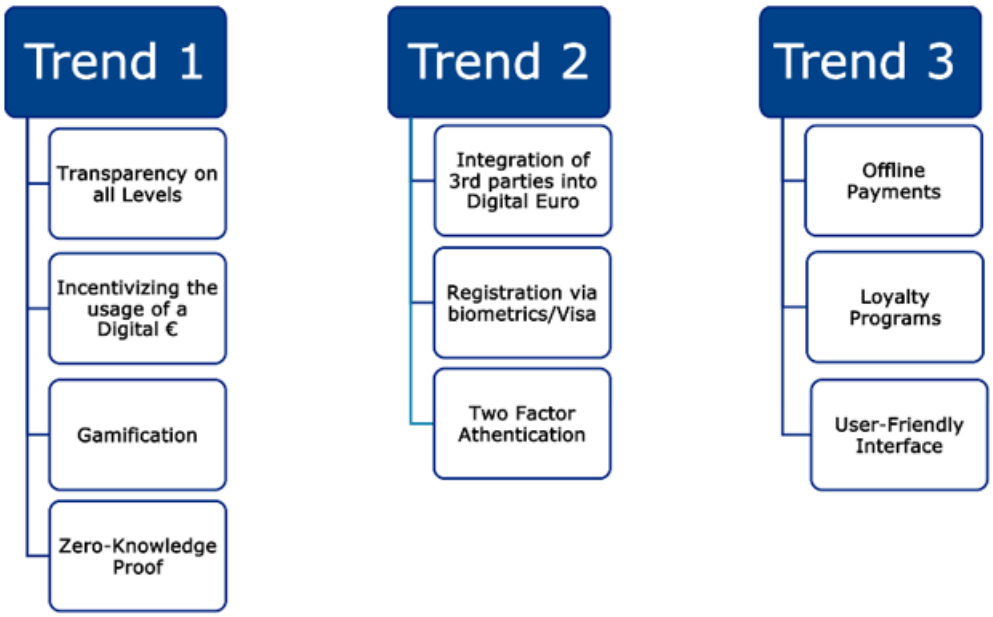

Figure 18: Overview of Developed Ideas and Solutions
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

[3] Following evaluation criteria were taken into account: creativity, novelty, problem solving capability, feasibility of implementation within the given boundaries until 2027.

4.2.1 Trend 1: Data & Privacy Concerns

The ideas for the first trend that received the highest score after being presented to the discussion panel were transparency, incentives for utilizing the digital Euro, gamification and Zero-Knowledge-Proofs.

Focusing on ideas related to the ***transparency*** of the digital Euro (Figure 19), the participants delved into various aspects related to the overall process of using the digital Euro and who would have access to the data and what kind of data would be involved. They explored the perception of data transparency, questioning the extent to which individuals would be sharing their private data, such as demographics and geographics, in comparison to commonly used standardized apps like Facebook. The solutions generated for transparency were to identify and communicate with all stakeholders, to use consistent communication channels, develop world-class customer support, have an AI-based first-level support, where users can ask any questions. Furthermore, education campaigns could be organized, such as open lectures at universities where people can learn the basics about Data & Privacy in the context of a digital Euro and classes at Austrian schools, so that the financial literacy of the general population increases. Information about the digital Euro should also be included in the app. Another important aspect is that communication should not be exclusively through central banks and commercial banks, as some people distrust them and the negative associations may influence the perception of the digital Euro. Last but not least, the ECB and the national central banks in the euro system should lead by demonstrating the desired behaviors, qualities, and values through their own actions. It involves setting a positive and influential example for others to follow, rather than solely relying on words or instructions.

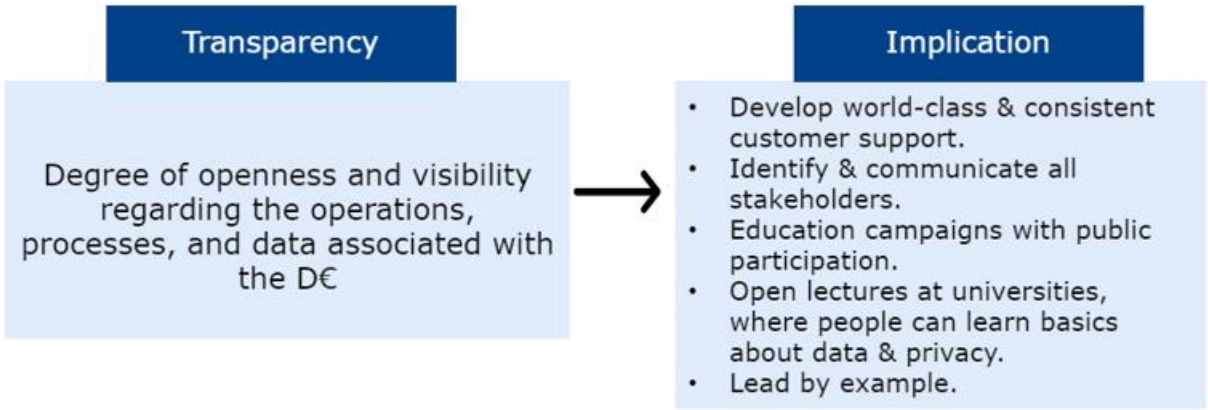

Figure 19: Transparency Overview
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

Furthermore, the team discussed the possibility of ***incentivizing the use of the digital Euro,*** so users have the motivation or an incentive to use it. The electronic payment system operates within a market characterized by strong network effects, underscoring the importance of ensuring widespread acceptance

of a digital euro from the outset. While a legal obligation for merchants to accept the digital euro in point-of-sale (POS) transactions will be established, no individual can be compelled to accept a digital euro in peer-to-peer (P2P) payments. Therefore, it is essential to create incentives to encourage widespread adoption of the digital euro from the start.

One way to do it would be through gamification to encourage the process of adoption. One proposed solution to incentivize the use of the digital Euro is to implement a concept where individuals are rewarded with digital Euros as they increase their knowledge and understanding of the digital currency, the Euro area, and the European Union. By offering digital Euros as a form of incentive, users would have a tangible benefit for engaging with and learning about the digital Euro. Furthermore, to encourage early adoption of the digital Euro, early adopters could be subsidized by receiving a percentage of the amount they have spent using the digital currency. This form of subsidization would provide an additional incentive for individuals to embrace and actively use the digital Euro in their transactions. To further incentivize merchants to accept and promote digital Euro transactions, there could be additional services or perks offered. These could include benefits such as special discounts, or access to exclusive promotional campaigns, effectively rewarding and encouraging merchants to embrace the digital Euro as a preferred payment method. The use of the digital Euro could also be encouraged through providing "cashbacks" to Environmental, Social, and Governance (ESG) investment schemes. Using the digital Euro could involve incentivizing and rewarding individuals who invest in ESG-focused projects or companies with a cashback mechanism facilitated through the digital Euro.

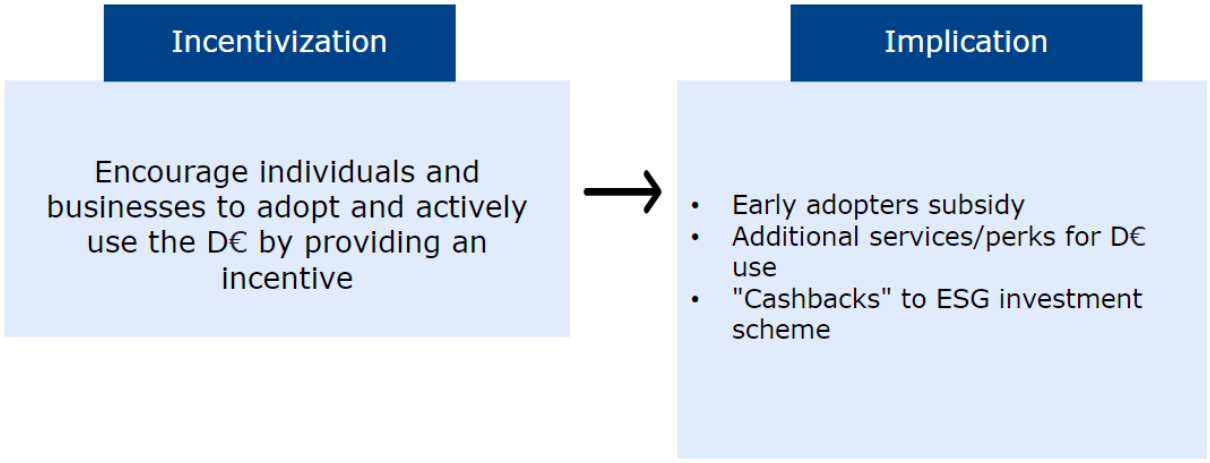

Figure 20: Incentivization Overview
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

In addition to the aforementioned ideas, another proposed solution is to use ***gamification*** for the adoption of the digital Euro (Figure 21). Countries could explore the possibility of transitioning their existing payment schemes, such as the "Klimabonus" in Austria, to utilize the digital Euro as the primary currency

for transactions. By enabling payments to be made directly in the digital Euro, individuals would be incentivized to engage with the digital currency and integrate it into their daily financial activities while also promoting other plans and initiatives. This strategic shift would leverage the existing infrastructure of established payment schemes while promoting the benefits and convenience of the digital Euro. The remaining ideas like earning digital Euros by learning about the Eurosystem are enumerated in the figure below.

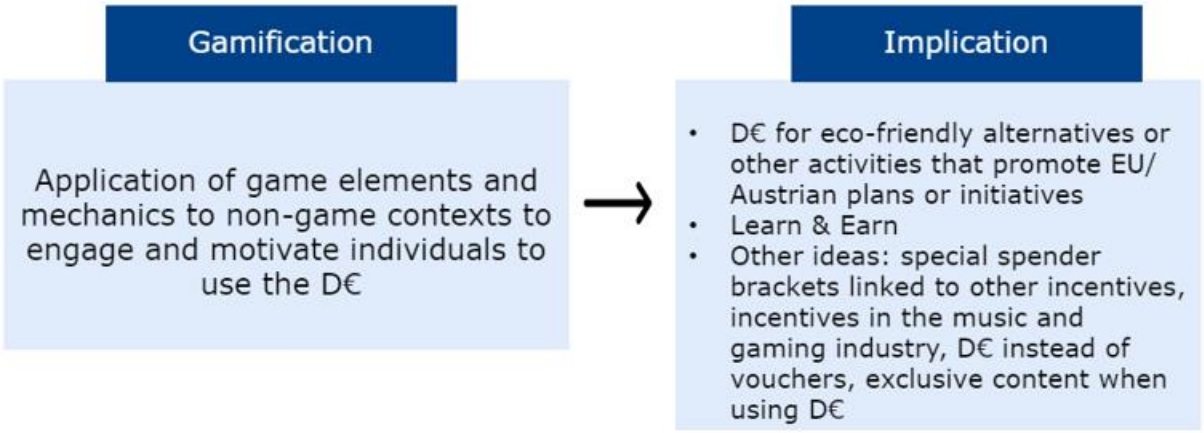

Figure 21: Gamification Overview
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

A further proposal was the idea of ***Zero-Knowledge Proofs*** (ZKPs). ZKPs enable the validation of a claim without disclosing any details about the statement in question (Goldwasser, 1985).

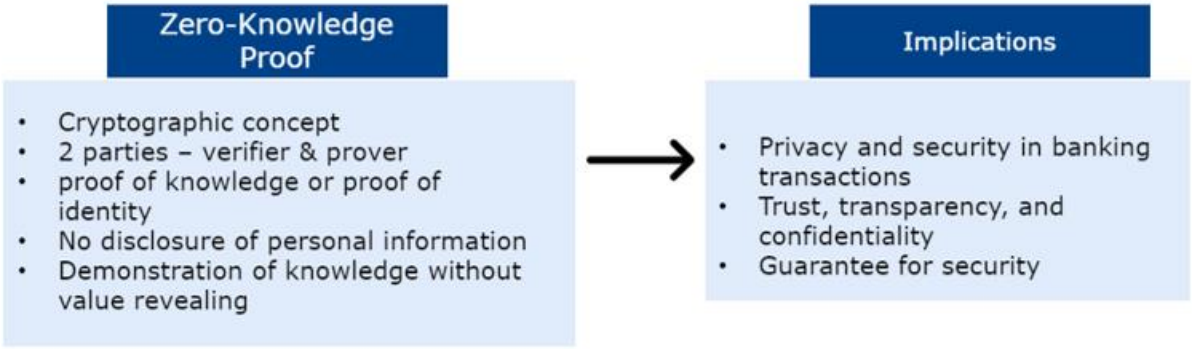

Figure 22: Zero-Knowledge Proof Overview
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

In a ZKP, two parties are involved: the prover and the verifier (see Figure 22). The prover aims to establish a claim, and the verifier is accountable for verifying the claim. The prover can demonstrate to the verifier that a statement is accurate without revealing any supplementary information regarding the statement. This is done by providing proof, or a small amount of information, that can be verified by the verifier to ensure

that the statement is true. (Hergovič, 2023) One example of a ZKP is a proof of knowledge (Figure 23). In this scenario, the prover demonstrates their knowledge of a specific value without revealing the value itself. Another example is a proof of identity, where the prover can authenticate their identity without disclosing any personal information. These applications can be highly valuable for the banking industry (Gross, Sedlmeir, Babel, Bechtel, & Schellinger, 2021), especially in the context of the digital Euro. With ZKP protocols, data privacy is guaranteed, addressing concerns about the privacy of user data. This assurance can increase user adoption and foster confidence in the digital Euro.

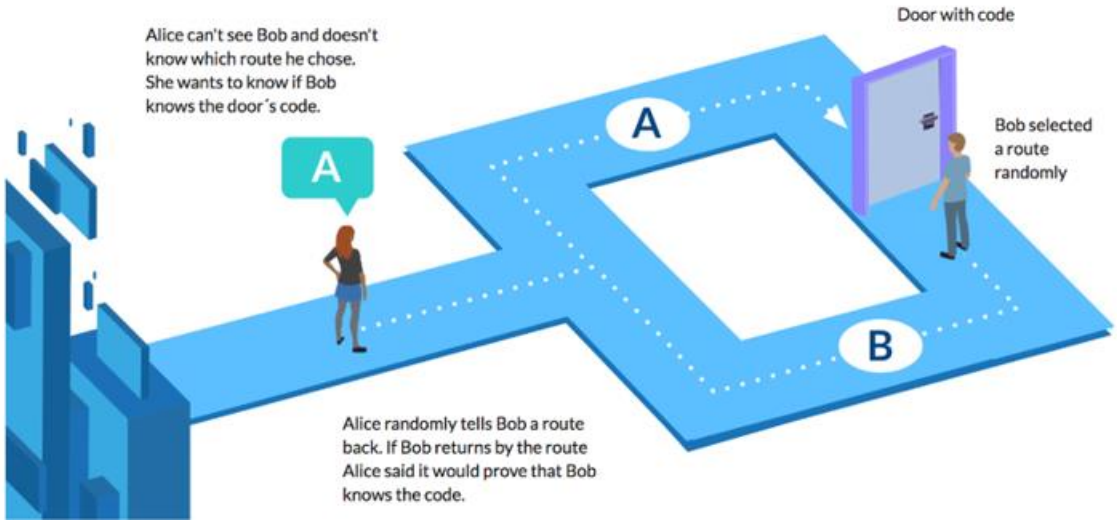

Figure 23: Zero-Knowledge Proof Practical Example.
https://www.bbva.com/en/zero-knowledge-proof-how-to-maintain-privacy-in-a-data-based-world/

Another challenge the team tackled was the perception of the digital Euro among the general public and the importance of fighting the negative image associated with "bad banks" that has been tainted by the financial industry. They noted that while people readily accept the idea of paying with their data for free services, like Facebook or any other social media, there is a lack of proper understanding of the digital Euro and how it works. Cross-checking different perceptions of the ECB across different European Union (EU) countries, as a one-size-fits-all solution might not be effective everywhere, was suggested. Recognizing the importance of political and marketing campaigns, the team emphasized the need for strong campaigns to promote the benefits of utilizing the digital Euro compared to other means of payment.

To receive more in depth information on how the ZKP method works and how it could be used for the digital Euro, expert Martin Hergovič was requested for further information, which will be detailed and extended in the following. It is important to mention that the ZKP method is explained with regards to its current application to blockchain technology and that the aspects mentioned in the following paragraphs are highlighted because they may be tailored to suit the digital Euro.

The question of whether real-time transactions with large volumes could be achieved using ZKP depends on the definition of "real-time." Currently, leading zero-knowledge roll-ups like zkSync Era process up to 2,000 transactions per second, with the potential for even higher scalability in the near future. To provide context, VISA currently processes approximately 1,700 transactions per second (Ledger.com, 2022). As new blockchains facilitating ZKP technology emerge, faster speeds and improved efficiency are being achieved.

Regarding transaction amounts, it could be a viable solution to only enable payments up to a certain threshold using ZKP. However, it is important to note that limiting payments to a specific amount may increase the likelihood of costs surpassing the transaction sum. Technical standards integrated into smart contracts could allow for "pre-paid/sponsored" transaction fees, either borne by the recipient with the European Central Bank (ECB) covering them. It is crucial to highlight the importance of private and public networks of blockchain or digital currency in this application. (Schmidt & Wagner, 2019) Notably, the aforementioned use requires running blockchain on a public permissionless blockchain or digital currency network. If the transactions are effectuated through a private permissed network, the sponsor (in this case the ECB, for example) the costs can be determined by the said sponsor.

In terms of disadvantages or problems with using ZKP for the digital Euro, one drawback could be the novelty of ZKP technology and the related development capacities. It is important to note that the digital Euro should operate on its own dedicated high-throughput infrastructure to avoid high fees and congestion during peak usage times, as experienced by public blockchains like Ethereum.

A concluding recommendation for the development of the digital Euro is not be overcautious when exploring technically innovative solutions. Development teams working on such solutions are generally supportive, eager to consult, and provide information and support.

4.2.2 Trend 2: Universal Transmission

The following solutions were discussed in the first round of brainstorming sessions: NFC cards, default cards that are available for purchase (or for free to fully ensure Universal Transmission) at supermarkets, digital Euro accounts based on QR codes, connecting transmission into existing networks, biometric digital identity connected to the digital Euro, text message digital Euro transfer, third party entity for passive cards, and multi-factor identification. These existing solutions were then presented in the main group, in which the aforementioned topics were voted on according to relevance, and a ranking was established. The top three most popular, and, hence, most relevant topics were selected and then discussed in more detail in the second break-out session.

In the second group discussion, the topic of Universal Transmission was explored more deeply. We began with a brainstorming session to understand the overall implications of this trend. After that, the group looked at existing solutions for sharing information, implementing transactions and discussed how to make them work in various scenarios, such as in areas with poor internet connection or where only one person has a smartphone. Unlike the first panel which mainly explored digital solutions, this group decided to revisit the core concept of Universal Transmission. The group agreed to view Universal Transmission not just as internet access, but as general access to digital tools, with special attention given to the financial and social status of the users. From this starting point, three topics were identified: integrating third parties into digital Euro, two-factor (multi-factor) authentication, and social implications. Those were considered as the most vital due to the knowledge of Lead Users.

The first topic was ***having a third-party entity for passive card transactions***. This means connecting the digital Euro to an already existing and trusted network that is nonetheless easily accessible, such as ATM machines, vending machines (food, tobacco), or potentially petrol pumps at petrol stations (Figure 24). An integration of the digital Euro into such networks would allow for direct and immediate access to large established and already trusted networks.

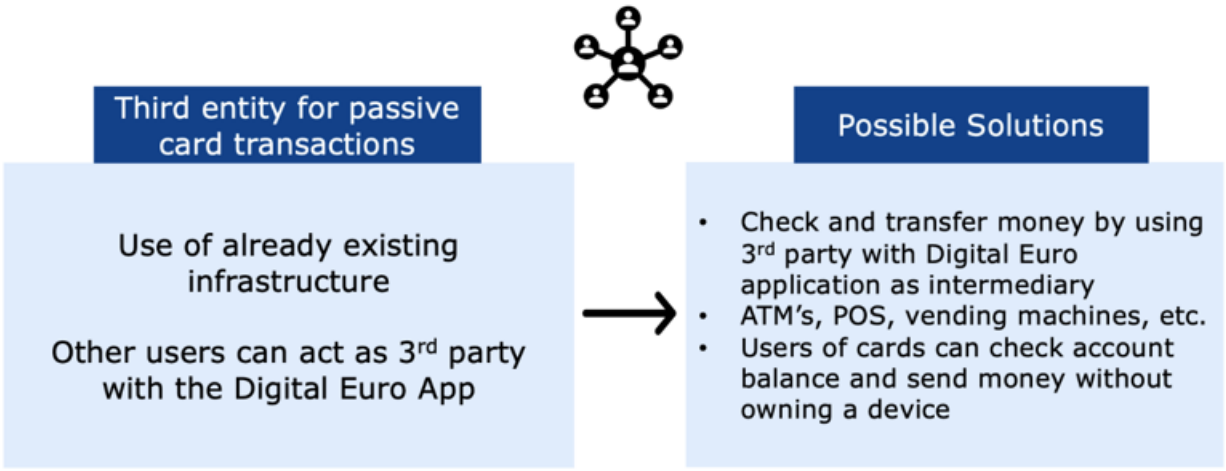

Figure 24: Third Entity for Passive Card Transaction
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

Secondly, the issue of ***two-factor (multi-factor) authentication*** was discussed. More specifically, ensuring that the transferred sum is indeed being transferred to the desired party, and done so with the knowledge and approval of the bank account owner (Figure 25). The discussed solutions to this issue were retina-scanning (an idea from the CEO of Open AI), as well as fingerprint identification. However, the first solution was prioritized, due to the inaccuracy and unreliability of fingerprint-based identification methods. Implementing this solution would mean connecting the biometric data with a digital Euro account, meaning

a more direct way of identification. However, this raises questions regarding the scalability of such a solution.

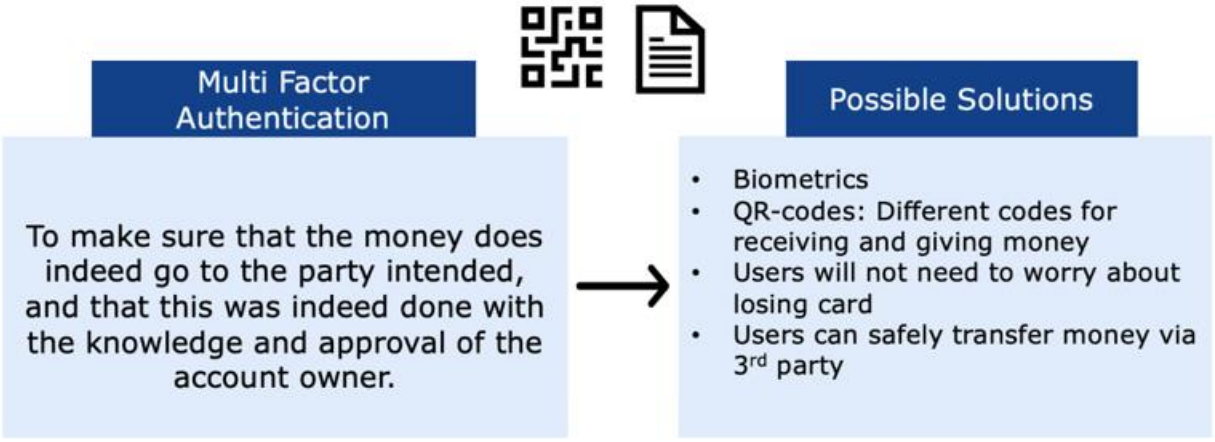

Figure 25: Multi Factor Authentication
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Finally, we explored the ***social implications***, particularly how to ensure every EU citizen can access the digital Euro, even without a phone or internet connection (Figure 26). One potential solution could involve linking a digital Euro account to each European citizen's passport. We also proposed creating a unique QR-code or NFC Cards for each digital Euro account, allowing users to send or receive money at certain scanning terminals. We suggested placing these terminals in police stations to provide a secure place for individuals to handle their financial transactions and seek help if necessary. However, we identified certain groups, like tourists, who might encounter difficulties with this setup. To address this, we considered granting a digital Euro account to anyone who obtains a European VISA or crosses a European border.

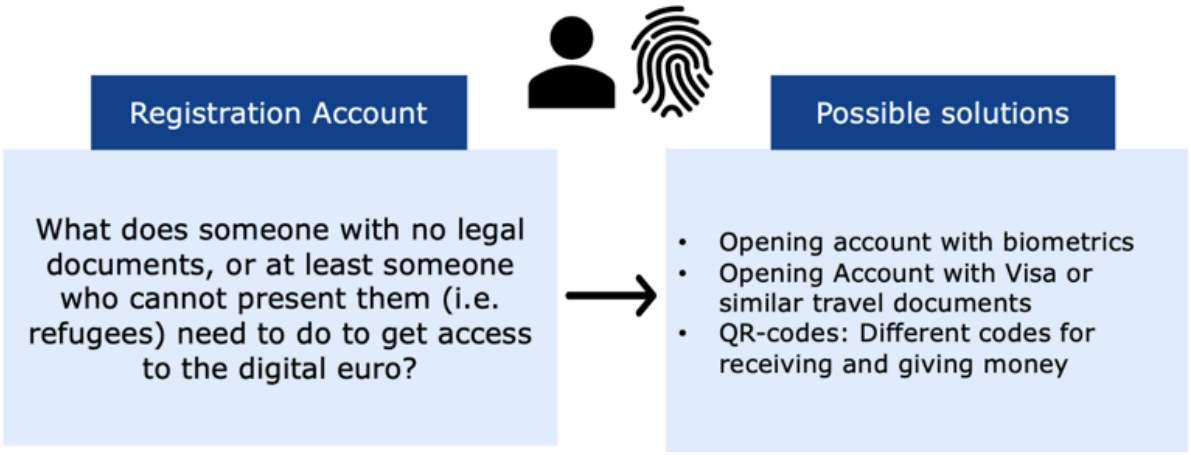

Figure 26: Social Implications Overview
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

4.2.3 Trend 3: Integration (Into Daily Life Habits)

The third team focused on viable solutions related to how to integrate the digital Euro into everyday life and discussed different options that would allow the new digital currency to be adopted in everyone's daily life habits. Particularly, they have been taking into consideration all aspects that would make the digital Euro easier to be utilized on a daily basis, while keeping the same characteristics of the cash version of the euro. These considerations have allowed the generation of different ideas. The chosen ideas discussed in detail include offline payments, loyalty programs and a user-friendly interface.

The first idea generated revolved around the importance of ***making the digital currency available in offline settings***. This is, in fact, one of the main characteristics of the cash version of the euro, and remains, among others, one of the most important features that will have to be made available with the launch of the digital Euro (Figure 27). This also relates back to many of the problems discussed in the second breakout room and the trend of Universal Transmission. Hence, it is of primary importance that the digital Euro is made available in offline payment settings. This represents a niche case but is a necessary feature for real life situations. Particularly, when talking about offline settings, what is meant is to provide the opportunity to pay not only when there is no internet connection, like on a plane or in the countryside, but also when the tools utilized have no more battery. In this context, one distinguishes between potential tools that can be used for the transfer of the digital Euro, and the technologies that can potentially be used for the offline transfer. In the first case, the team considered the use of physical cards, mobile phones, wearables such as rings or glasses and phone cases. Particularly, in the case of physical cards, the possibility of using solar energy cards in order to avoid the battery charge problem has been discussed. In the second case, concerning the technology to use, the team talked about the possibility of ***paying without a device***, but rather with login data and passwords or a code, as well as through the use of biometrical factors, chips inserted into the human body or by adopting proximity technologies, such as NFC, QR, Bluetooth, Airdrop, etc.

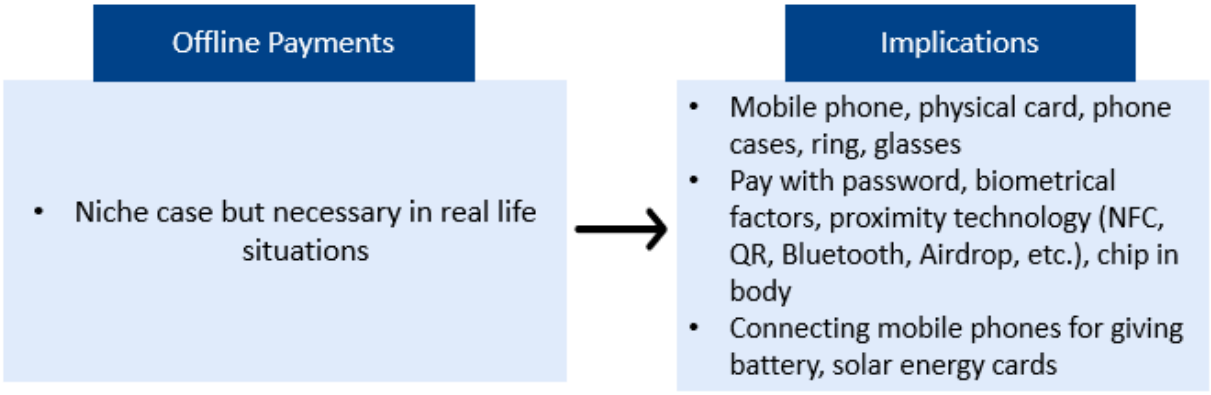

Figure 27: Offline Payments Overview
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

Secondly, in order to motivate the use of the digital Euro, during the general discussion it has been decided to focus on ***loyalty programs***. Back in the breakout session, the sub team discussed the most viable solutions and best ideas related to such a program. (Figure 28) Starting with a welcome bonus and the opportunity to start transactions at no cost, the group evaluated the possibility of providing discounts and loyalty benefits (e.g., some sort of benefit for the salary). Moreover, inspired by the Chinese so-called credit system, it has been said how it could be possible to allow consumers to collet credits if using the digital Euro for specific purchases, as for example when buying vegetables and fruits, or generally by following a healthy lifestyle. With regards to the loyalty program, furthermore, the importance of creating a standardized program/platform has been considered in which it would be possible to aggregate all the digital Euro wallet benefits and programs of external partners. In fact, one of the generated ideas is to allow merchants to upload and propose their own programs, which would hence require the platform to be compatible with third parties.

Furthermore, the team has made clear that, regardless of whether the digital Euro will be managed on an app in its own right, or included in other platforms and/or apps, the interface needs to be kept user-friendly in order to allow the user to have an easier experience to manage one owns digital Euros. Next, it was also recommended to implement further features for the use of the digital Euro, such as investment options and possibilities. The third point that has been raised considered the necessity, again on the digital Euro app or on related platforms, to give the final users access to a saving section. This has been demonstrated to be an important tool for other financial services providers, and it is essential that the CBDC offered by the European Central Bank provides a similar widget. Yet, the relevance of distinguishing this additional section from the other available options on the market has also been discussed, to stimulate its usage and give a reason to the savers to choose the ECB alternative.

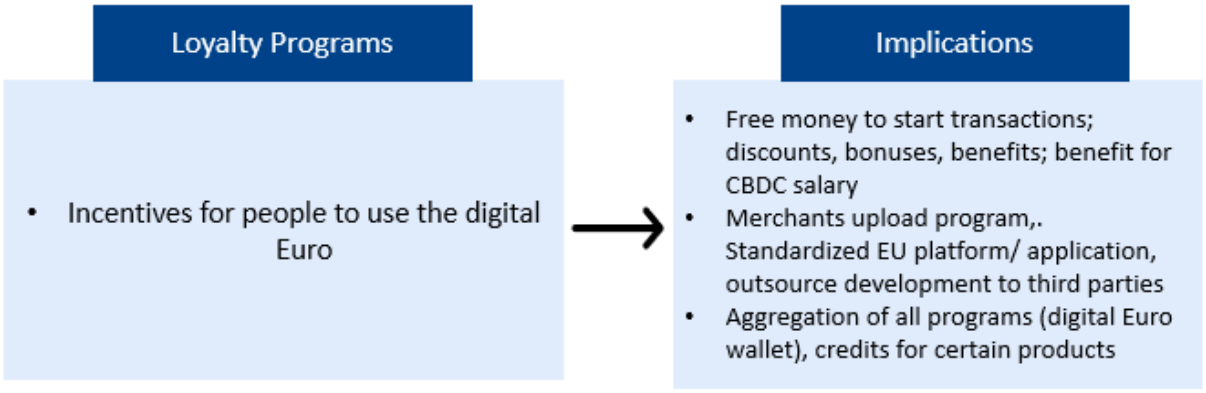

Figure 28: Loyalty Program Overview
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

Finally, the third idea that has been chosen during the main discussion has been the necessity of offering a ***user-friendly interface***. (Figure 29) In fact, the team went further and suggested tailoring the offering in accordance with cultural differences by providing a different access or landing page for each country. Hence, the goal would be to create "a type of application programming interface that enables developers to access information from multiple sources through a single interface" (Srivastava, 2023). It is moreover important to integrate access to a unique digital Euro wallet to other fintech realities, to allow access from different platforms (feature that obviously requires compatibility with the other apps). To conclude, the team also discussed the importance of guaranteeing security standards, in order to provide the final consumers with the confidence that their money is secure. For instance, to connect ones' e-wallet, users will need to go through security processes and steps, or else the use of the digital wallet will require additional steps such as 2-steps identification.

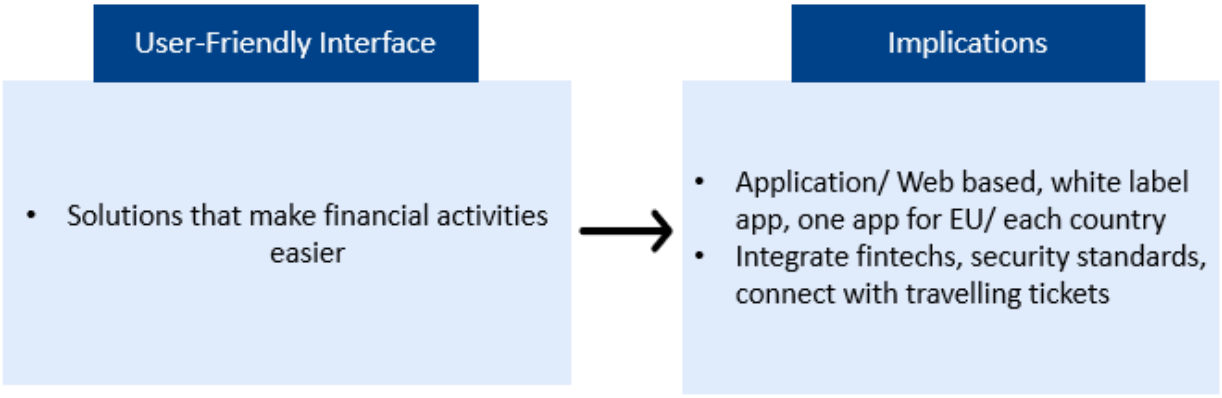

Figure 29: User-friendly Interface Overview
Internal Figure (2023), Institute of Entrepreneurship and Innovation, Vienna University of Economics and Business

Additionally, an important topic touched upon is the necessity of incentivizing users to adopt the digital version of the Euro, to the detriment of the current digital currency system in circulation, i.e., the Euros offered by commercial banks. In fact, to properly integrate the digital Euro into the daily habits of people, particularly in the early stages of the project launch, it is important that users decide to use the digital Euro more frequently instead of the digital currency put into circulation by the current private financial institutions. This can be done by incentivizing the use of CBDCs through different channels and methods. For instance, in the second breakout session the team conversed about the possibility of achieving this goal using discounts, loyalty programs, cashbacks and by connecting different organizations. All this has also been compared to the Chinese system and their implementation of the digital Yuan, as receiving credits for specific buying behaviors resembles somehow the credit system in China, in which specific behaviors and

buying option can give you credits and benefits, which might negatively affect the perception of freedom and security/privacy of "no government control" the Central Bank is aiming (if we consider the first trend). Finally, following the lead of Mr. Korpos, the team generated ideas on "how to use" for investment purposes. Most notably has been the conception of allowing end users to use the digital Euro at their disposal to invest in government bonds and other financial instruments that are otherwise not (easily) accessible to retail investors. This also includes the importance of offering such opportunities relatively cost effective, by reducing, among other obstacles, the transaction costs and commissions associated with the exchange of the financial instruments.

4.3 Conclusion

In conclusion, the project highlights key trends and concepts that hold significant importance for the Austrian National Bank as a partner in this initiative. It is recommended that the OeNB takes decisive actions to ensure the successful implementation and adoption of the digital Euro.

Transparency emerges as a crucial aspect, demanding clear communication and data privacy. The OeNB should address data transparency concerns and prioritize the privacy of user information. By implementing transparency ideas, the OeNB can establish itself as a reliable authority, fostering confidence among users and stakeholders.

Driving adoption is essential, and the OeNB must embrace incentivization strategies. This can involve gamification techniques and subsidizing early adopters. These measures will motivate individuals and merchants to actively use the digital Euro, ensuring its stability and viability.

Seamless integration into daily life habits is key to widespread acceptance. The OeNB should prioritize offline payments, user-friendly interfaces, and customization to cater to diverse user preferences. By making the digital Euro accessible and convenient, it will be embraced as a preferred payment method.

Data & Privacy concerns could be addressed by implementing **Zero-Knowledge-Proofs**. The Eurosystem should prioritize data privacy to ensure the digital Euro is a secure and reliable digital currency.

Through the identification of and workshop with Lead Users, this project was able to identify ways in which the results mentioned above could be obtained. An emphasis was placed on solutions relating to the three main trends identified: Data & Privacy Concerns, Universal Transmission, and Integration Into Daily Life Habits.

Fostering a positive reputation is crucial. The OeNB's active participation in promoting transparency, incentives, and user-friendly features will position it as an innovative and customer-centric central bank. This will strengthen its position domestically and internationally, contributing to the overall success of the digital Euro.

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Appendix

Appendix Table of Contents

Phase I Appendix

I.1 Consolidation of Working Papers 1

Retail Stores Often Oppose New Payment Solutions

Major US Retailers are opposed to accepting new electronic forms of payment like Apple Pay or Google Pay, most often in pursuit of establishing their own payment solutions (e.g., their own apps). This behavior could also be adopted by European retailers in the future.
(Wallstreet Journal, 2022; PYMNTS, 2022)

Generational Shift

As the European work force demographic is changing, it is estimated that 75% of the European work force will consist of Millennials, who will notably inherit a substantial wealth. This demographic shifts will also cause the needs and workings of the financial market to change towards a faster-paced and more creative innovation cycle. Already it can be seen that Millennials are eager to invest their wealth and trends will naturally form around this direction.
(Deloitte, 2022; The Financial Brand, 2022; Business Transition Forums, 2022)

Amount of Credit Institutions

The number of credit institutions is declining in the EU. The decline marked -3.3% YOY in 2021 and a staggering -35% compared to 1999. This dynamic, in combination with a growing population and more people having access to bank accounts, the remaining credit instructions hold a larger absolute number of customers, as well as a larger relative figure of the population.
(EBF, 2022; Statista, 2022)

Omnichannel Engagement Possibilities

The trend towards a seamless customer experience doesn’t halt at the financial sector. Thus, financial enterprises will have to rethink their future needs and adopt to new customer expectations in the field of omni channel experience.
(Forbes; 2023, IBM 2022)

Greater Need for Advanced Analytics

While user data analytics is normally used for commercial purposes like advertising tracking, anonymized user data can also provide valuable insides into the current state of the economy, whilst not infringing user data privacy. A detailed insight into the population’s demographics, spending habits and other behavior.

This also provides an enormous potential in terms of fraud prevention and identifying risks. Based on this, data management is likely to gain rapidly in importance.
(Forbes, 2022; TreasureUp, 2023)

Changes In Operating Models

Financial institutions and FinTechs must develop and put into practice a strategic orientation towards digital assets in order to get there. Market developments demonstrate that digital assets are already having an impact on several business sectors of traditional financial institutions. Thus, it is crucial that all suppliers of financial services assess the strategic relevance of digital assets for their respective business models and map out a clear course of action. Since the market is developing at an increasingly rapid pace, market players that don't adapt quickly are in danger to be left behind.
(Finextra, 2022; ResearchGate, 2023)

Target Customers of Banks

The period of extremely low interest rates has come to an end because of recent central bank activities. Banks are shifting to an economic model that is more heavily reliant on deposits than on lending. Many people think that physical distribution branches are essential for luring and keeping deposits. Several banks are anticipated to focus more on serving the requirements of wealthy clients as capital surpluses rise. This change will probably result in more industrial innovation and competition. Less wealthy customers are in risk of being neglected and their needs getting less attention, as financial service providers will tend to rather focus on financially better off customers.
(The Banker, 2023; SmallBusinesses, 2021)

Aging Population

The EUs population is noticeably aging, customer demands and expectations are shifting too. Older people tend to possess less technical ability and competences, this will have to be considered by financial service providers in future. User interfaces will have to be simple for everybody to understand and run on many end user devices. It is not an option that a significant part of the population is overwhelmed by the using requirements of future payment methods.
(Visual Capitalists, 2022; WeForum, 2022)

Cryptocurrencies: Bear Market takes Hold

As of early 2023, cryptocurrency clearly sits in a bear market, as asset prices are down, and investors flee. The term "crypto winter" has seen a substantial increase in search results. Currently the market cap is down

65% compared to all time highs in 2021. While estimates about the long term future of the crypto currency markets are hard to make, it is safe to say that it will remain highly volatile and unpredictable for the near future.
(Exploding Topics, 2023; CoinDesk, 2023; OliverWymanForum, 2023)

Geopolitical Situation

In the last few years global politics have become more heated. Chinas growing economy and military has already caused several confrontation points with the USA. Despite these two nations being economically tightly intertwined, both are seeking to distance themselves from their adversary long term in certain aspects. Also, the European continent has undergone geopolitical fractures, mainly due to Russia's attempt to invade Ukraine. The EU has clearly distanced itself from the Russian economy and almost all of Russia's natural resources, which just until recently made up a significant chunk of Europe's energy source. Furthermore, many western nations have cut off Russia from the SWIFT system, significantly limiting their access to the worldwide financial world.
(KPMG, 2023; Bruegel, 2022; EuropeanGeopoliticalForum; 2023)

Fractured Banking Landscape

Customers are becoming more skeptical of international institutions as social trust towards many governments declines. Smaller and local banks are the primary benefactors of a supervisory regime and attitude gravitates towards nationalistic protection. Capital and client shifts towards more locally focused banks is likely to lead to smaller balance sheets, lending facilities and in general will cause an emergence of more players operating in their respective niches.
(PWC, 2023; TimeMagazine, 2022; ECP Forum, 2023)

The Winner Takes It All

Big tech brands or similar innovator can quickly adapt to new user behaviors and changing markets. This enables them often to quickly capture most of a market with an innovative product. Part of their strength is being able to offer a homogenous front end user design across their products. Established players like national banks mostly have to deal with outdated technology being used by themselves and complex binding local legal regulations.
(PWC, 2023; FAZ, 2019)

A Market of Opportunity

The age of digital banking could be said to be one of the biggest changes in the banking sector ever. Banks being able to connect themselves worldwide with other banks and customers making instant payments across the globe. As more and more people in developing nations gain access to internet and thus online financial systems, many new market areas and opportunities are emerging, waiting to be explored and captured. Established financial institutions as well as new players stand to being able to immensely benefit from these many changes.
(PWC, 2023; Allied Market Research, 2019)

Presence of Fintech companies

Fintechs in Europe have become major banking institutions, with some now ranking among top five in several major European economies. They are said continue to grow and gain market share in a long term. Fintechs bring much needed movement into the financial sector and so increase the quality and quantality of products available for customers. In this way the competition they bring is a vital part to modernizing the financial landscape.
(McKinsey, 2022; Twitter, 2023)

Tech Companies in Finance

The COVID pandemic has arguably been one of the strongest most recent drivers for adoption of new tech. It has significantly and lastingly changed user behavior across many industries, not making halt at the financial sector. 40% of people in the Eurozone decided to use less cash, thanks to health and hygiene concerns raised during the pandemic, thus significantly raising the popularity of electronic payment methods. Such payment instructions saw a 400% increase in their income in certain countries in 2021.
(Eurofi, 2022; Reddit, 2022)

Fintech regulations

Borderless markets, cutting-edge financial services technologies, and new business models are anticipated thanks to digitalization. Fintech, or financial technology, is attempting to enter this sector as an additional player. New legislative initiatives have been developed to level the playing field for all participants and to rethink the conventional concepts of capital flows and instruments as well as the risks associated with opening the capital market up to new participants in order to increase the integrity of the EU common market and the size of its capital market.
(Cidob, 2023; Campridge Forums, 2023)

Digital Payments

In recent years, the market for new payment methods and alternative means of payment has evolved greatly. The way payments are processed and the devices through which they can be initiated have become increasingly diverse. While it used to be common to carry cash and cards, payment methods via smartphone are now ubiquitous. In addition, biometric payments and cashierless shops are increasingly being discussed. However, these technological advances also bring new challenges. Payment service providers have to deal with significant risks, which have increasingly become the focus of regulators in recent years. (FMA - Finanzmarktaufsicht, 2022) (Aktuelle Trends im Digital Payment - Die Zukunft im Blick, o. D.) (Santander, 2023) (European Central Bank, 2022) (Intelligence & Intelligence, 2023) (Khaitan, 2022) (PricewaterhouseCoopers, o. D.)

Blockchain-Technology

A blockchain is a shared, non-manipulable registry (also called an account ledger, transaction ledger or ledger) that facilitates the process of recording transactions and tracking assets on an enterprise network. An asset can be either tangible (a house, car, cash, land) or intangible (intellectual property, patents, copyrights, trademarks). Almost anything of value can be tracked and traded on a blockchain network, significantly reducing risks and costs for all parties. („Was ist Blockchain-Technologie? – IBM Blockchain | IBM“, o. D.) (Was ist die Blockchain-Technologie? – Blockchain erklärt – AWS, o. D.-b) (TechCrunch is part of the Yahoo family of brands, o. D.-b) (2023a) (Bambysheva, 2023)

Financial inclusion

Financial inclusion refers to the provision of affordable and relevant financial products and services that cater to the needs of individuals and businesses, including transactions, payments, savings, credit, and insurance. These services should be delivered in a responsible and sustainable manner, ensuring accessibility to all. (Overview, o. D.) (Alliance for Financial Inclusion - Homepage, o. D.) (Business Standard, o. D.) (Financial Inclusion, 2020) (Homepage | Center for Financial Inclusion, o. D.) (Financial Inclusion | Poverty Eradication, o. D.) (How „financial inclusion“ can lift millions out of poverty: World Bank Economist, 2022) (G20 High-Level Principles for Digital Financial Inclusion | GPFI, o. D.) (Sustainable Development Goals - UN Capital Development Fund (UNCDF), o. D.) (European Investment Bank, 2022)

E-Commerce

The digital transformation is causing changes in consumer behaviour. The increased use of the internet and smartphones in the purchasing process results in new buying habits. The practical tips for dealing with

digital customer behaviour help you to react to the change and show you what you need to pay attention to. (TechCrunch is part of the Yahoo family of brands, o. D.-c) (2023b) (E-Commerce und Webshop, 2022) (Baluch, 2023)

Artificial Intelligence

Artificial Intelligence, or AI, is a discipline of computer science that deals with methods enabling machines (computers) to solve tasks as a human would with their intelligence. AI not only covers aspects of information technology but has also been influenced by psychology, neuroscience, linguistics, communication sciences, mathematics, and philosophy. Computer science can be seen more as a means to an end, as it brings together various research areas and enables practical implementation of AI. (Google AI, o. D.) (OpenAI, o. D.) (Gambit, o. D.) (What is Artificial Intelligence (AI) ? | IBM, o. D.) (Burns et al., 2023) (OMR, 2022) (Insights on Artificial Intelligence, 2022) (Pant, 2021) (DeepMind, o. D.) (Wilkins, 2023)

Internet of Things

IoT, also known as the internet of Things, describes the network of connected devices and technology enabling communication between devices and the cloud, as well as between devices themselves. With the advancement of cost-effective computer chips and high-bandwidth telecommunications, billions of devices can now connect to the internet. This has allowed everyday devices, including toothbrushes, vacuum cleaners, cars, and machinery, to collect data using sensors and respond intelligently to their users. (Burgess, 2018) (Clark, 2020) (Was ist IoT? – Internet der Dinge erklärt – AWS, o. D.) (Meola & Meola, 2023) (2023a) (Internet of Things (IoT) Solutions - Intel, o. D.) (Internet of Things (IoT) Products & Solutions, 2023)

Data protection

National and international laws, industry standards, data protection authorities, privacy policies, and privacy advocates all play a significant role in data protection. Countries have specific laws and regulations for data protection, and many industries have established standards and best practices. Data protection authorities enforce these laws and regulations, and companies and organizations have their own privacy policies. Privacy advocates and experts work to promote data protection and raise awareness about privacy issues.

The safeguarding and confidentiality of personal data are crucial concerns for the Federal Ministry of Finance (BMF) and all relevant bodies within the finance department that are responsible for data protection. („Datenschutz-Grundverordnung (EU) 2016/679“, 2016) (EU-Datenschutz-Grundverordnung

(DSGVO): Das österreichische Datenschutzgesetz - DSG, 2022) (Datenschutz, o. D.) (2019) (Data Protection, o. D.)

Decentralisation

Development policy defines decentralisation as the transfer of political decision-making powers, administrative responsibilities, and state funds from the national government level to the regions and municipalities of a country. This approach aims to enhance government services, promote transparent and efficient use of public resources, and align resource allocation with actual needs. Furthermore, decentralisation seeks to strengthen political participation processes in local communities. (OECD, o. D.) (Dezentralisierung, o. D.) (Division of Powers, o. D.)

Digitalisation of enterprises

The digital Euro could help to accelerate the digitalisation of companies, as digital financial transactions could be processed more quickly and easily. (Kelly, 2022) (For companies, o. D.) (How COVID-19 has pushed companies over the technology tipping point—and transformed business forever, 2020) (Liyanage et al., 2020) (Brauweiler et al., 2020)

Internationalisation

Internationalisation cannot be used synonymously with globalisation. Through globalisation, however, internationalisation has become increasingly prominent. Internationalisation is the term used to describe a company's decentralised market behaviour. This means that it no longer focuses only on its home market or home country, but expands its own services or products into other countries. (Oesterle & Wolf, 2014) (2022) (Internationalisierung, o. D.) (Internationalisierung, Bildung, Qualität und Transparenz Internationalisierung | Agentur für Bildung und Internationalisierung, o. D.)

Cybersecurity

Cybersecurity or IT security is the protection of networks, computer systems, cyber-physical systems and robots from theft or damage to their hardware and software or the data they process, as well as from disruption or misuse of the services and functions they provide. The data is both personal and operational. (Cybersicherheit - Bundeskanzleramt Österreich, o. D.) (Cybersicherheit - Bundeskanzleramt Österreich, o. D.) (Was ist Cybersicherheit? | IBM, o. D.) (o. D.) (Cybersecurity Consulting Services | Accenture, o. D.) (Jaggi, o. D.) (Christou, 2015)

Smart contract

A smart contract works like a traditional contract and sets out the terms of an agreement. However, unlike a traditional contract, the terms of a smart contract are executed in the form of code on a blockchain like Ethereum. With smart contracts, developers can build applications that leverage the security, reliability and accessibility of the blockchain while offering cutting-edge peer-to-peer functionality - including credit, insurance, logistics and gaming. (Fries, 2019) (Wilkens & Falk, 2019) (Was sind Smart Contracts in einer Blockchain? | IBM, o. D.) (2021) (Was ist ein Smart Contract?, o. D.)

Tokenization

Tokenization is the process of replacing a sensitive identifier with a non-sensitive alternative that lacks any inherent or exploitable significance. These substitutes, known as tokens, are utilized in lieu of identifiers to represent users in databases or during authentication transactions. To produce tokens, the original data is mapped using techniques such as randomization or hashing algorithms, rendering it virtually impossible to reverse-engineer the tokens without access to the tokenization system.

(Crypto Finance AG, 2023)

(Business Standard, o. D.-b)

(FMA - Finanzmarktaufsicht, 2022)

(Digitalisation and tokenisation for funds | CMS Funds Group, o. D.)

(PricewaterhouseCoopers, o. D.-b)

(Tokenization | Identification for Development, o. D.)

(Lacity & Treiblmaier, 2022)

Automation

Automation refers to technology that operates with minimal user intervention. This encompasses various forms of automation, such as business process automation (BPA), IT automation, and personal applications such as homepage automation, among others.

(Was ist Automatisierung? | IBM, o. D.)

Micropayments

Micropayments, also known as microtransactions or micropayments, refer to transactions or payments involving small amounts typically ranging from EUR 0.01 to 0.05. If the amount is only a few cents, it may be referred to as a nanopayment or picopayment. The term macropayment, on the other hand, is used for amounts exceeding EUR 5.

https://cs.stanford.edu/people/eroberts/cs201/projects/2010-11/MicropaymentsAndTheNet/solutions.html

https://www.faz.net/aktuell/wirtschaft/netzwirtschaft/mikrozahlungen-wie-bezahlen-wir-morgen-im-internet-11065817.html

Social banking

It refers to financial and banking services with the primary objective of promoting the development and prosperity of people and the planet in the present and time to come. This entails considering the social, environmental, cultural, and economic impacts of activities at all levels, with a focus on minimizing negative effects and maximizing positive effects on the common good.

https://www.erstegroup.com/de/ueber-uns/social-banking

https://www.bankaustria.at/ueber-uns-verantwortung-social-impact-banking.jsp

https://katalog.wu.ac.at/primo-explore/fulldisplay?docid=WUW_alma5184105700003337&context=L&vid=WUW&lang=de_DE&search_scope=WU-Bibliothekskatalog&adaptor=Local%20Search%20Engine&isFrbr=true&tab=wuw_alles&query=any,contains,social%20banking&offset=0

https://www.social-banking.org/wp-content/uploads/2017/08/ISB_Definition_SocialBanking.pdf

Open banking

Open Banking refers to a collaborative model that involves various players, including both banks and non-banks, working together to create innovative products and services utilizing open technology platforms, shared workspaces, knowledge sharing, customer bases, and data.

https://katalog.wu.ac.at/primo-explore/fulldisplay?docid=WUW_alma51120978880003337&context=L&vid=WUW&lang=de_DE&search_scope=WU-Bibliothekskatalog&adaptor=Local%20Search%20Engine&tab=wuw_alles&query=any,contains,open%20banking&offset=0

https://katalog.wu.ac.at/primo-explore/fulldisplay?docid=WUW_alma51124548040003337&context=L&vid=WUW&lang=de_DE&search_scope=WU-Bibliothekskatalog&adaptor=Local%20Search%20Engine&tab=wuw_alles&query=any,contains,open%20banking&offset=0

https://www.pwc.at/de/dienstleistungen/unternehmensberatung/risk-consulting/future-open-banking.html

https://www.mckinsey.com/industries/financial-services/our-insights/data-sharing-and-open-banking

https://www2.deloitte.com/de/de/pages/financial-services/articles/open-banking.html

https://www.oesterreich.gv.at/lexicon/O/Seite.991603.html

Mobile payment

The term "mobile payment" denotes a payment method that is cashless and contactless and involves the use of mobile devices at the point of sale (POS).

https://katalog.wu.ac.at/primo-explore/fulldisplay?docid=WUW_alma5184799240003337&context=L&vid=WUW&lang=de_DE&search_scope=Artikel&adaptor=Local%20Search%20Engine&tab=wuw_nur_pc&query=any,contains,mobile%20payment&facet=searchcreationdate,include,2015%7C,%7C2023&offset=0

https://www.pwc.at/de/publikationen/financial-services/mobile-payment-report-infografik.pdf

https://www.bsi.bund.de/DE/Themen/Verbraucherinnen-und-Verbraucher/Informationen-und-Empfehlungen/Online-Banking-Online-Shopping-und-mobil-bezahlen/Mobile-Payment-Mobil-bezahlen/mobile-payment-mobil-bezahlen_node.html

Contactless payment

Contactless payments involve tapping a contactless-enabled payment terminal with either a payment-enabled mobile or wearable device or a contactless chip card. This technology is utilized by various devices, including cards, phones, and watches. Tapping to pay enables a secure, touch-free, and convenient checkout experience.

https://usa.visa.com/pay-with-visa/contactless-payments/contactless-payments.html

https://www.icicibank.com/blogs/credit-card/what-is-contactless-payments

E-wallets

The term stands for "electronic wallet". It is also called a cyberwallet or digital wallet. An e-wallet is a digital system that stores information for payment. It exists only electronically and is a secure payment method that is widely used.

https://www.bitpanda.com/academy/de/lektionen/was-ist-eine-wallet-und-wo-bekomme-ich-eine/

https://www.forbes.com/advisor/credit-cards/how-to-use-a-mobile-wallet/

Peer-to-Peer payments

P2P payments simplify the transfer process as the sender only requires the recipient's phone number or email address, instead of an account number. The convenience of smartphones enables access to recipient data from contact lists. These transfers are instantaneous and free, leading almost 50% of consumers to consider P2P payments as faster and more straightforward than traditional transactions.

https://www.ifhkoeln.de/peer-to-peer-zahlungen-bequeme-und-schnelle-zahlungsoptionen-werden-in-zukunft-noch-wichtiger/
https://www.nerdwallet.com/article/banking/p2p-payment-systems

Biometric authentication

Biometric authentication employs a person's physical features such as fingerprints, iris, retina scans, or other characteristics to verify their identity. The number of characteristics used depends on the system and desired level of security. Biometric authentication generally maps the physical trait to a username for decision-making after authentication. Sometimes the user enters the username during authentication, while other systems perform a lookup on the biometric sample to identify the username.
https://www.onlinesicherheit.gv.at/Services/News/Biometrische-Authentifizierung.html
https://www.bsi.bund.de/DE/Themen/Verbraucherinnen-und-Verbraucher/Informationen-und-Empfehlungen/Technologien_sicher_gestalten/Biometrie/AllgemeineEinfuehrung/allgemeineeinfuehrung_node.html
https://www.pwc.de/de/finanzdienstleistungen/biometrische-authentifizierungsverfahren.html
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8970854/
https://www.sciencedirect.com/topics/computer-science/biometric-authentication
https://www.zukunftsinstitut.de/fileadmin/user_upload/Megatrend_Doku/MT_Maps_und_Grafiken/Megatrend_Map_EN_MTD21.pdf https://www.relevance.com/tech-publications/

Decline in the use of central bank money

The use of cash has been gaining momentum in the European Union for several years. Not only in Europe but in many parts of the world, cash is no longer king, and digital payments have increased and become the norm (Auer et al., 2022). One of the drivers of this trend is the COVID-19 Pandemic, as shown in the third section of the working papers (Auer et al., 2022). The data implies the rise of contactless transactions and the acceleration of the adoption of payment apps. Even though downloads had been rising before the pandemic, during 2020 and 2021, a significant increase occurred between January and March. In November, India experienced another wave of COVID-19 infections, which has led to another peak in downloads, affecting the global total (Auer et al., 2022).
However, even before the pandemic the decline in cash use can be seen in the European Union. In 2022 the Study on the payment attitudes of consumers in the euro area (SPACE) came to the conclusion that cash was the most frequently used payment method at the point of sale and was used in 59% of transactions, down from 79% in 2016 and 72% in 2019 (ECB, 2022). The reasons for the decrease are several – convenience of the digital payments, which can be done quickly from a smartphone or a computer, increased

prevalence of contactless payments, allowing customers to make purchases without the need to touch anything. This has become especially important during the pandemic, as consumers sought and were asked to avoid touching surfaces.

Auer, R., Cornelli, G., Frost, J. (2022). The pandemic, cash, and retail payment behavior: insights from the future of payments database. BIS Working Papers, *1055*, 2-9. https://www.bis.org/publ/work1055.htm

European Central Bank. (2022). Study on the payment attitudes of consumers in the euro area (SPACE). https://www.ecb.europa.eu/stats/ecb_surveys/space/html/ecb.spacereport202212~783ffdf46e.en.html

Source: Websites -4, Newspapers-1, Journals -10, Forums-3

Income inequality

Income equality is essential for the EU for several reasons. First, it promotes social cohesion and stability, as people are likelier to feel a sense of justice and fairness. Second, income equality can help improve economic growth and productivity. When people have equal access to education, healthcare, and other resources, they are more likely to be able to contribute to the economy and realize their full potential. In addition, greater income equality can help reduce poverty and increase consumer spending, which can boost economic growth (Gupta et al., 1997). Furthermore, income inequality can negatively affect democracy and political stability, as it can lead to more significant influence by the wealthy and powerful in the political process and a sense of disillusionment and frustration among those who feel left behind (Posner, 1997).

Even though inequality in the European Union has slightly declined by the end of 2016, the trend after the beginning of the COVID-19 pandemic shows that the short-term outlook is rather grim. Due to the different restrictions in the European Union member states, many vulnerable groups suffered income losses– students, part-time workers, and workers in the tourism industry and low-income households(Fischer, 2021).

Fischer, G., Filauro, S. (2021, April 17). Income inequality in the EU: General trends and policy implications. Voxeu Column. https://cepr.org/voxeu/columns/income-inequality-eu-general-trends-and-policy-implications

Gupta, S., Clements, B., Gillingham, R., Schiller, C., Verhoeven, M., Alonso-Terme, R., Mourmouras, A. (1997, January). Should equity be a goal of economic policy?. International Monetary Fund. https://www.imf.org/external/pubs/ft/issues/issues16/

Posner, R. (1997, October). Equality, wealth, and political stability. Journal of Law, Economics & Organization, 13(2), 348–349. https://www.jstor.org/stable/765095

Source: Websites -4 , Newspapers-0 , Journals -4 , Forums-0

Cash and digital payments are transforming the humanitarian aid

According to the review of IRRC (Burton, 2020) CVA (Cash and Voucher Assistance) has revolutionized humanitarian aid in the last ten years. Cash has emphasized humanitarian help on the choices of the affected people. With digitalization spreading in many sectors and increased digital payments, the world is more connected than ever.

However, this ubiquitous connectivity requires and generates a significant amount of data, which governments, companies, or other third parties can surveil. Humanitarian action has adapted to the new reality and has started making digital payments to the affected – through mobile phones, smart cards, or people's bank accounts. It is the digitalization of cash delivery, not just the cash itself, that is the game changer (Burton, 2020). In spite of the fact that digital payments are faster and more convenient, they are not safe enough from cyber-attacks and spying software becoming cheaper (Burton, 2020).

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

Source: Websites -0, Newspapers-0 , Journals -1 , Forums-0

Interest in privately issued digital assets

Over the last decade, the world has witnessed an increasing interest in digital asset investments, with transaction value growing from 1,934 million USD in 2017 to 36,761 million USD in 2022. Traditional financial transactions can take days to process and they often involve high transaction fees. However, digital asset transactions are processed instantly and at a fraction of the cost, making them an attractive option for international trade and commerce (Statista, 2023).

These digital assets, also known as native digital assets, have a value determined by the market – they are not backed with a real-world physical asset like property, currency, or a piece of art (Koens, 2020).

Therefore, a future trend we might witness is a reduced percentage of banked individuals who prefer faster and cheaper payment methods instead of traditional bank accounts and cash, leading to financial exclusion and discredited authority of the central banks.

Koens, T. (2020). The Future of Digital Assets: Trends, Challenges, and Opportunities. *ING* https://www.ingwb.com/binaries/content/assets/insights/themes/distributed-ledger-technology/the-future-of-digtal-assets-whitepaper.pdf

Statista. (2023). Digital Assets – Worldwide. https://www.statista.com/outlook/dmo/fintech/digital-assets/worldwide

Source: Websites -2, Newspapers-2, Journals -8, Forums-

Trend(s)	Description and additional information
The use of **cash** might be on a decline, however, many people are not willing to let go of cash completely since cash has some benefits that can hardly be replaced by any other form of money, such as securing privacy or immunity against cyber-attacks.	Bank notes and coins issued by the central banks still represent a widely used and broadly accepted means of payment. Even though some argue that cash payments are -especially on the global level- declining (Lebow, 2022)[2], which seems to have been accelerated by the COVID-19 Pandemic (R/AskAnAmerican, 2021)[3], it is very improbable that cash will cease to exist completely. To give an example, in numerous European countries like Greece, Spain, Italy, Germany or France, cash has in the recent past been widely used by households with regards to the point-of-sale purchases (Armstrong, 2019)[4]. Moreover, the recent Austrian Referendum for Unrestricted Cash Payment ("Volksbegehren für uneingeschränkte Bargeldzahlung") which was supported by more than 530.000 signatures ("Volksbegehren 'FÜR UNEINGESCHRÄNKTE BARGELDZAHLUNG,' 2022)[5], (*Facebook*, n.d.)[6] shows, that a considerable part of the population views the access to this payment method as a fundamental right and one of the pillars of their freedom, autonomy and privacy (Weiß, 2021)[7], (Grundrecht auf Bargeld und Uneingeschränkte Barzahlung, 2019)[8], (European Central Bank, 2020a)[9], (Potacs, 2022)[10]. This seems to be an important fact that should also be considered when designing a central bank digital currency: a CBDC should not try to replace or restrict cash, it should rather complement it, which currently seems to be also the goal of the digital Euro (European Central Bank, 2021)[11]. Other notable advantage of cash is the fact that it is a legal tender, which means that generally speaking, no creditors in a particular country can refuse it (European Central Bank, 2020b)[12], however, this would also be true for the digital Euro (European Central Bank, 2020c)[13]: Moreover, cash is also immune to cyber-attacks, which is very relevant nowadays, since the number of cyber-attacks has increased 125% globally while the World Economic Forum´s Global Security Outlook report indicates that this number is going to grow in the future. (*Davos Annual Meeting 2022 - Global Cybersecurity Outlook - Original*, 2022)[14]. And while technology and digitalization has led to a significant advancements in many areas -transferring and storing wealth as well as paying for goods and services included- it has made individuals, organizations or even whole countries more vulnerable to digital attacks (Agrafiotis et al., 2018)[15].
Trends with respect to the use of **credit cards** and **debit cards**: increase in contactless payments, biometric authentication, sustainability as an increasingly important aspect, the possibility to buy cryptocurrency using debit and credit cards	Both credit cards as well as debit cards refer to commercial bank money. Unlike the central bank money, this money is intangible and it is actually a promise of the commercial bank to repay the debt they have in respect to the depositor (Bollinger, 2011)[16] and it is not guaranteed by the central bank that the deposited money (that exceeds a certain given amount) will be actually converted to cash (*Can You Stop a Bank From Going Bust?*, n.d.)[17]. In fact, commercial banks do not really store the total sum of cash which would be equivalent to the amount of money their customers have on their accounts, but only a certain ratio of this money which is set by the central bank and held there as well (European Central Bank, 2016)[18]. This can become a problem if a bank run occurs (Hayes, 2021)[19]. Nevertheless, many

	people use credit or debit cards as they are widely accepted and easy to use (R/AskEurope, 2019)[20]. Firstly, as already mentioned, digitalization and contactless payments are on the rise and this trend has been accelerated even more by the recent COVID-19 pandemic (Kapoor et al., 2022)[21], (Fegatelli, 2022)[22]. For example, the Chinese Government has even introduced the possibility to pay with one´s own face for the use of the public transport system (*Facial-recognition Payment on Subways, Buses in China's Guiyang - Xinhua | English.news.cn*, n.d.)[23]. On a smaller scale, biometric data is used all around the world for PIN authentication (Nilsson, 2021) [24] as well as for other purposes - e.g., increasingly for medical purposes- (Singh & Krishnan, 2023)[25]. However, the use of biometric recognition raises concerns with regard to increased surveillance and some people doubt that such data will be used only for payments (R/Damnthatsinteresting, 2023)[26]. Secondly, another trend worth mentioning is sustainability. While sustainability is a hot topic in many different contexts, credit and debit cards are trying to become more eco-friendly and "green" as well (*The Life Cycle of an Eco-friendly Bank Card: Supporting Your Sustainable Practices*, 2022)[27], (*Promoting Environmental Sustainability | Mastercard*, n.d.)[28], (Crail, 2023)[29]. Another trend is the possibility to use credit and debit cards to buy cryptocurrency (Bannermanquist, 2022)[30]. This possibility is offered e.g. by Uniswap Labs in cooperation with MoonPay (Uniswap Labs, 2022)[31], (*Buy Crypto With Your Card or Bank Account*, 2022)[32].
Trends with respect to **digital wallets** (Mobile Payments): greater interoperability, new challenges to the traditional understanding of banking as well as legal challenges	Another trend, which is closely related to the use of credit cards and debit cards are digital wallets like Apple Pay, Google Pay or PayPal One Touch (Corporate Finance Institute, 2022)[33] . These allow users to pay with their mobile phones by storing their credit and debit card information (Kagan, 2022)[34]. Even though the introduction of digital wallets does not represent a financial revolution on its own, they are certainly a part of the financial evolution and they are posing a challenge not only on the level of the legal regulation (Westermann, 2022)[35] but as well as to the traditional understanding of banking (Heredia Salazar, 2017)[36]. An interesting point is that by enabling purchases with digital wallets, the sales are likely to rise (Po, n.d.)[37].
Trends with regard to **CBDCs**: CBDCs can become means of financial inclusion, however, they are causing concerns, especially regarding privacy and anonymity	CBDCs are digital versions of a country´s physical currency (Digitales Zentralbankgeld (CBDC) - Blockchain center, 2021)[38]. This form of currency -especially the digital Euro- should be "cheap and easy to use, secure, risk-free, efficient and (…) anonymous" ("DIGITAL EURO," 2021)[39]. Other Proponents of CBDCs emphasize the potential of this type of currency to facilitate the inclusion of the poor (Martin, 2019)[40]. While CBDCs are sometimes described as "digital cash", this name could be rather misleading since it is not yet guaranteed that its level of anonymity will be able to even compete with tangible cash (*Digitales Zentralbankgeld (CBDC) - Blockchaincenter*, 2021b)[41]. Even though the European Central Bank refers to the EU-form of central bank digital currency -the digital Euro- as a "risk-free form of money" (European Central Bank, 2022)[42], some voices are expressing their concerns regarding the implementation of

	CBDCs (R/Superstonk, 2023)[43], (What Do People Think About CBDC?, 2021)[44], (Tronnier et al., 2022)[45]. While the concerns related to the digital Euro are manifold (Tronnier et al., 2022)[46], see also Figure 1; one of the main concerns related to CBDCs is privacy. Since all transactions in a digital currency can be recorded, governments and central banks might be able to collect detailed information about the financial situation of individuals and companies by monitoring their financial behaviour in real time (S, 2023)[47].

Phase II Appendix

II. 1. Trend Analysis and the Determination of Lead Users

Analysis of customer-related trends which are relevant with respect to CBDCs, especially to the digital Euro. Defining Lead Users. Distinction between innovators, experts, and Lead Users.

Introduction

The aim of this paper is to provide a comprehensive understanding on the definition of trends, to summarize the trend analysis of the working papers I form the prior phase and to introduce and apply a new concept and methodological approach in form of the impact uncertainty matrix, as it provides a powerful tool in critically evaluating the results from the trend analysis research.

The second purpose of this paper is to provide an extensive exploration of the Lead User method and to distinguish it from other types of users, such as user innovators and experts. By drawing clear boundaries between these different user types, the paper seeks to provide a more nuanced and sophisticated understanding of how this method can be utilized to identify emerging market opportunities, generate novel ideas, and ultimately drive growth and success for an organization. In addition to exploring the distinctions between user types, the paper also presents various methodologies and tools that can be used to effectively identify Lead Users.

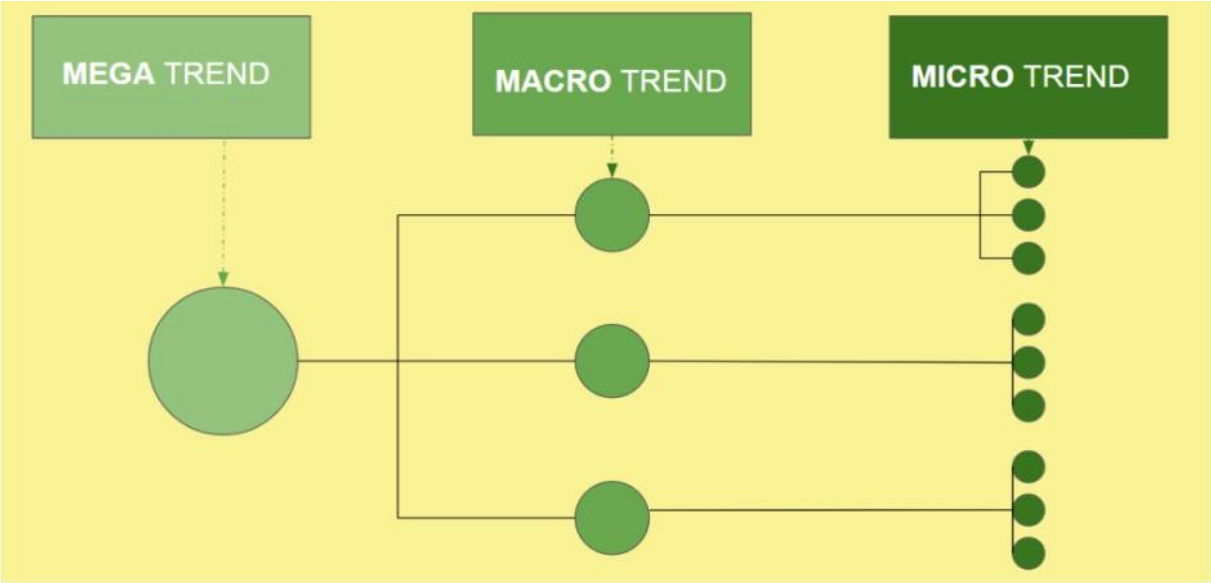
Definition of a Trend

At the outset, it is important to take the time and provide a clear definition of what a trend is, as it constitutes the foundation of the further analysis. A trend represents a deeper change within society or human behavior, which can be observed. Trends frequently depend upon each other, however sometimes they are difficult to detect (Mazzucato, 2023) and mostly fall into one of the three categories (see Table 1 below): megatrends, macrotrends and microtrends (globaltrendspotter.wordpress.com, 2017).

Megatrends frequently occur as a consequence of human behavior and are long-term factors by nature, which shape all affairs of human life. They are difficult to control or prevent and it is essential to recognize them as early as possible in order to respond to them in the proper way. Some examples constitute for instance the aging population, climate change, advancements in the technological sphere or urbanization (globaltrendspotter.wordpress.com, 2017).

Macrotrends are the so called “children” of megatrends and occur more often than their parents, however they are strongly correlated to the changes brought by the latter. They are commonly identified by analyzing the specific target regions of the megatrends. The megatrend of technological progress co-occurs with macrotrends such as machine learning and artificial intelligence (globaltrendspotter.wordpress.com, 2017).

Table 1. *Trends overview*



Note. Adapted from *globaltrendspotter.wordpress.com, 2017.*

Microtrends are the most frequently appearing tendencies as they incline to be dynamic and appear consecutively. They can be categorized into various classes, including marketing and media innovations, new technologies, service innovations, innovative business models, and numerous other subcategories. An example here would be the company Facebook in the beginning of the social-media era (globaltrendspotter.wordpress.com, 2017).

Having established a clear definition of a trend and its diverse manifestations, the following section of this paper will provide a summary of the outcomes obtained from Working Papers I and analyze the trends that have been commonly recognized by our peers.

Summary of the Trend Analysis

In this chapter we examine the different trend levels and outline the tendencies, which play a crucial role in the future needs and demands of the payment service users. Additionally, we group the most important trends for our project into 3 specific categories and set the stage for the further implementation of the impact uncertainty matrix.

In our analysis, we discovered that the papers exhibited a low emphasis on megatrends. The challenges of Europe's aging population for example were recognized as a trend only twice.
However, the contributions made were valuable and provided vital literature, which we can built upon in our further analysis if needed. Additionally, the trend of global warming was mentioned only once in a paper. Besides that, no other megatrends were listed in the papers and the advancement of technology and its implications towards the future needs of users were raised mostly on a micro and macro trend level, which will be outlined next.

The trend analyses had a strong emphasis on macrotrends such as the increasing demand of users towards new digital payment solutions and away from cash since the Covid-19 pandemic. Furthermore, the future needs and wants of users in terms of security and privacy in the payment service sector, where linked to microtrends, such as the expanding demand for innovative biometric authentication methods. The technological advancements in the spheres of machine learning, quantum computing and artificial intelligence were elaborated and linked to emerging trends in the implementation of digital wallets, mobile contactless payments solutions, and P2P transactions. Additionally, the overall direction of the payments service market towards digitalization and convenience of payments to meet future customer needs was stressed. Moreover, macrotrends such as the collection and utilization of big data among big corporations, banks and governments were linked to the vigorously emerging tendencies of user needs for innovative and safe data related privacy and security measures.

Due to the volume of distinct trends obtained from the working papers, we decided for reasons of simplicity to group them into three main categories. Such an approach will facilitate the utilization of the impact uncertainty matrix and lead to a more efficient, effective, and sophisticated understanding of the implications of the different trends. The first trend group covers all the progressive aspects of technology and digitalization and its effects on our future digital economy. The second class of trends

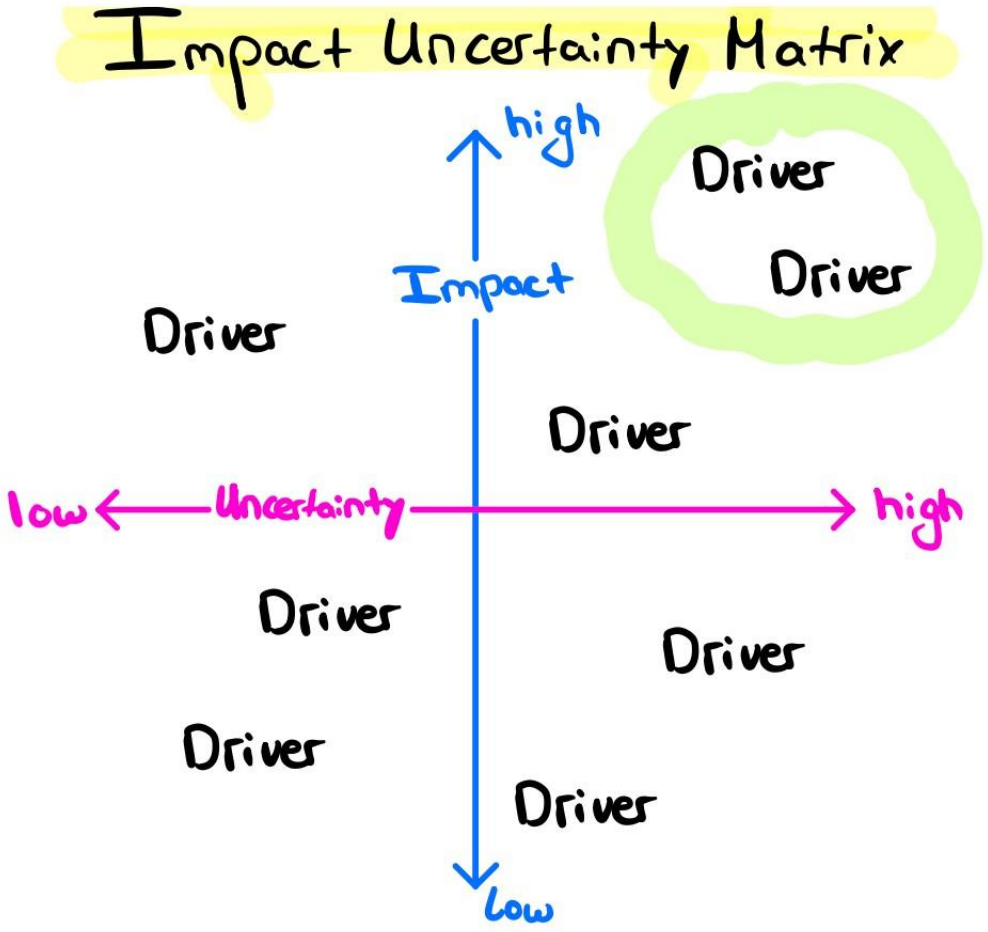
comprises the area we call “Security and Privacy”, which captures the specific future needs and wants of payment users. Lastly, we examine the megatrend of the aging population in Europe and its implications for the future of digital payments. The subsequent table 2. comprises the three groups of trends and their incorporated trend subgroups:

Table 2. The *three major trends and their trend subgroups*

Digitalisation of the Economy	Security and Privacy	Demographic Changes
▪ Digital wallets ▪ Contactless payments ▪ Mobile payments ▪ Machine Learning ▪ Artificial Intelligence	▪ Biometric Authentication ▪ DLT ▪ Artificial Intelligence ▪ Machine Learning ▪ Quantum Computing ▪ Encryption	▪ Aging Population ▪ Population Size ▪ Population Structure

The Impact Uncertainty Matrix

Figure 1. *Graphic representation of the impact uncertainty matrix*



Definition

The focus of this chapter will lie on the implementation of the impact uncertainty matrix, as it provides a powerful tool in critically evaluating the three classes of trends, which we defined above. The matrix consists of two dimensions: on the y-axis the potential impact of our trend is displayed by a scale ranging from low to high and on the x-axis the associated uncertainty resulting from this trend is similarly shown by an equivalent scale ranging from low to high (Mazzucato, 2023). Normally, the axes of the potential impact and uncertainty score are assigned by a predefined quantitative ranking system, depending on the choice of the analyst. Commonly, the ranking is ranging from 0 (low) to 10 (high) and is assigned before the plotting on both dimensions (Wulf et al., 2011).

Regarding the uncertainty scale, a score ranging from low to medium indicates that the future course of a particular trend is comparatively foreseeable in its future trajectory and has the potential to significantly impact an organization's future prosperity. On the contrary, it is challenging to predict the future implication of high uncertainty rating, also called “critical uncertainties”, as they can either have tremendously affirmative or undesirable effects upon the organization or society (Wulf et al., 2011).

The implications of a low to medium potential impact score must be acknowledged by an organization, however the resulting effects are rather minor on the overall business. Nevertheless, a high potential impact score is of substantial importance for an institution, as its effects have similarly to the critical uncertainties either an extremely affirmative or undesirable outcome. Lastly, trends which are located within the green area of the matrix (high potential impact and high uncertainty) are ones which need to be closely monitored by the institution, because of their severe magnitude and impact. Therefore, it is vital for an organization to conduct a trend analysis and utilize the concept of the impact uncertainty matrix, as it can identify those trends, which are high in potential impact and uncertainty and prepare for them (Wulf et al., 2011).

Application to our Trend Analysis

For our application of the three classes of trends within the impact uncertainty matrix, we choose a quantitative ranking score between zero and ten for both axes and subdivide the scale based on the following definition:

Table 3. Quantitative ranking scores

	Uncertainty	Potential Impact
Low	0-3	0-3
Medium	4-7	4-7
High	8-10	8-10

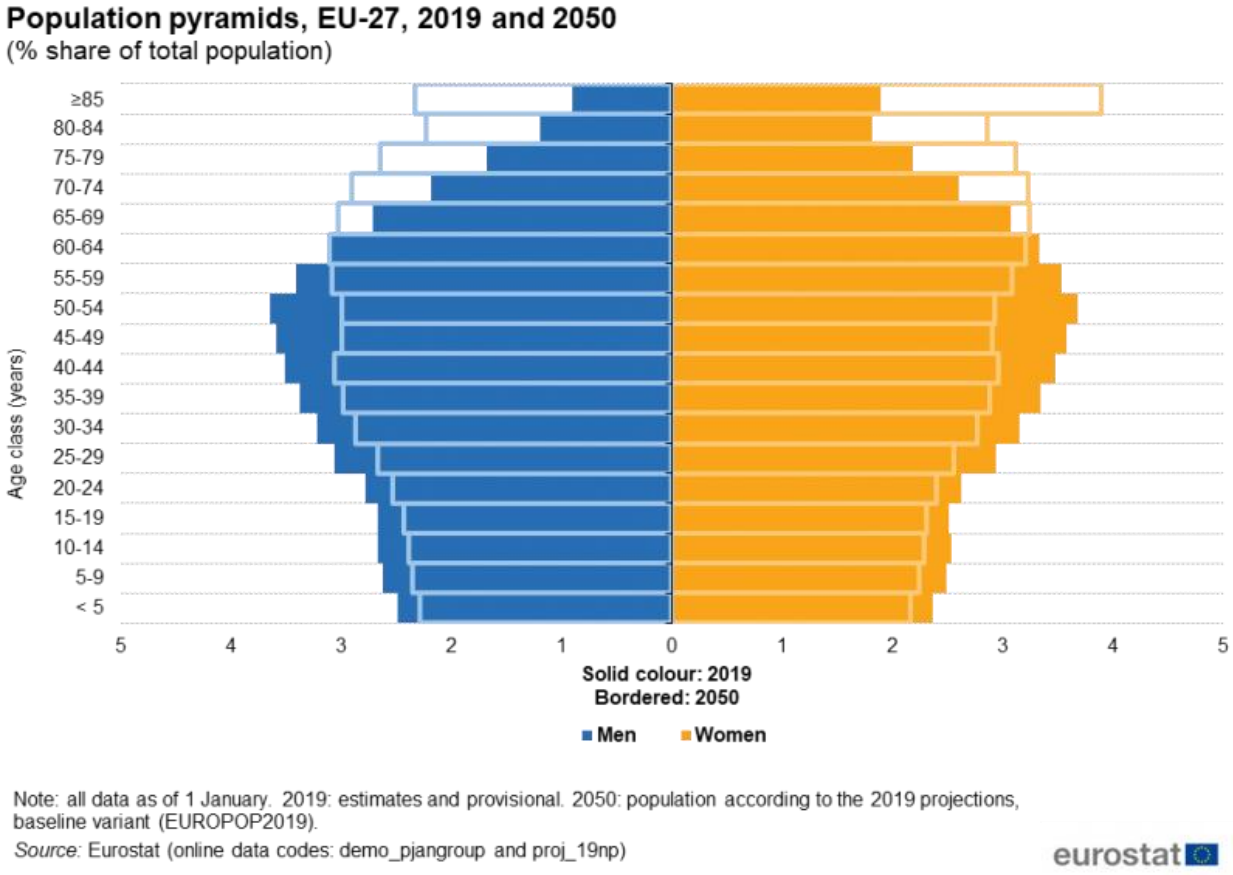
Firstly, we want to assign a score to the trend class digitalization of the economy. We believe that the potential impact upon our society is strong, as exemplified by our prior summary of the working papers. There will be an increased demand for digital payments in the future (World Economic Forum, 2023) and the importance of the digitalisation in the payment service industry, especially since the Covid-19 pandemic shows the increasing demand for digital payment solutions (Global Government

Forum, 2022). Further evidence of the emerging need for digital payments which are correlated with the development of our technological society (Khando et al.,2023) is provide scientific research. Accounting for all these progressive factors the category potential impact receives a score of 8.8 out of 10. Due to the fast-moving technological developments and digitalization, the uncertainty within this sector is rather high, as we cannot yet foresee in which way these effects will influence the design of the digital Euro. Therefore, we give a score of 8.5 on the uncertainty scale.

Next, we want to closer analyze the second group of trends under the category security and privacy. Microtrends such as the biometric authentication for digital payments is becoming increasingly important as a mean of verifying payments and security measure among customers. Due to the faster and more convenient verification, which is progressively advancing in the direction of automatic face recognition, eye scanners, fingerprint recognition, vein mapping and heartbeat analysis, there will be no need for pins and passwords in the future. Furthermore, the new biometrical authentication can prevent identity theft and fraud (Caramela et al., 2023). With the implementation of DLT (tokenize central bank currency through central bank digital currency and capability of digitally representing bank deposits) there can be higher security of private financial data during payments and an increase in the transaction speed. Recent projects, such as the ones in China and Sweden, show that DLT will play a vital role in the future digital monetary system and financial sector (Klein, 2020). Other aspects such as the advancements in machine learning, quantum computing encryption and artificial intelligence will further significantly influence this trend. Taking into consideration the above listed trends we give a score of 8.6 in terms of impact, as those factors and their advancements will push further improvements and 6.2 in terms of uncertainty, as those innovative concepts will meet future user needs for higher security and data protection and will have an affirmative effect upon the digital Euro.

Lastly, we analyze the demographic changes and its associated macrotrend of the increasing aging population. As statistics as well as future forecasts indicate, the population of the EU is ageing and the median age is projected to reach 48.2 years by 2050 (*Ageing Europe - Statistics on Population Developments*, 2020). Even in 2030, the percentage of the population above the age of 65 will be 23% (United Nations- Department of Economic and Social Affairs, 2018).

Figure 2. The Ageing EU-Population



This poses the question, in how far this substantial change in demographics could affect not only the economy of the EU, but also the preferred means of payments, above all the adoption and use of digital payment methods. Since several studies have found out that age plays a significant role in the adoption of cryptocurrencies (De Best, 2023), this might be the case also with the adoption of CBDCs like the digital Euro.

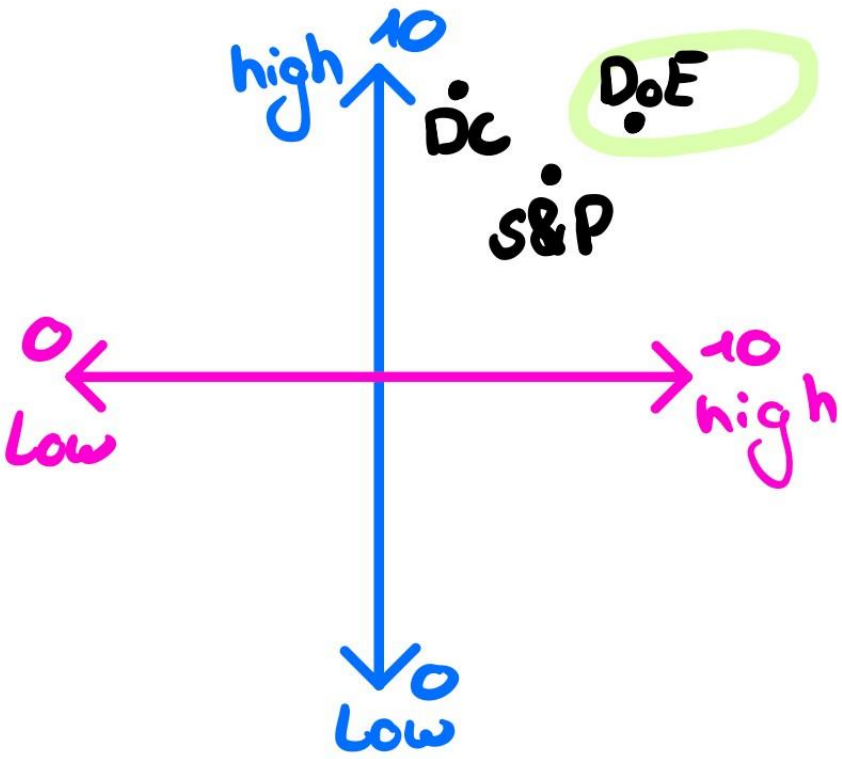
In view of this implications, we provide a score of 9.6 in terms of potential impact, as this is a megatrend, which is unavoidable and a medium score of 5.3 in relation to the uncertainty, as the continuation of this development is relatively certainty.

Table 4. Summary of the rankings

	Uncertainty	Impact
Digitalisation of the Economy (DoE)	8.5	8.8

Security and Privacy (S&P)	6.2	8.6
Demographic changes (DC)	5.3	9.6

Figure 3. *Graphic representation of the impact uncertainty matrix for our trend analysis*



Conclusion

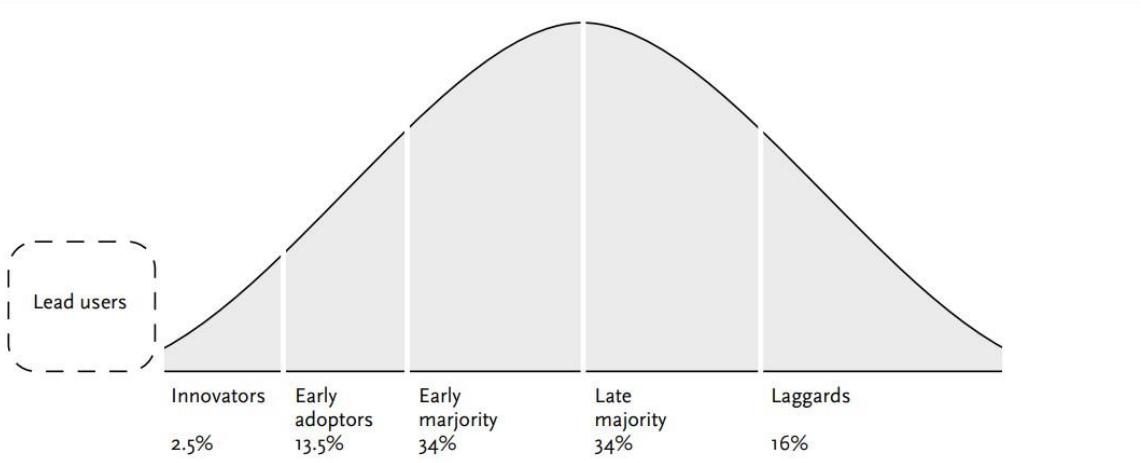
Based on the impact uncertainty matrix, it is evident that the ongoing shift towards the digitalization of the economy is a critical trend that warrants extensive further investigation and analysis. The high level of significance attributed to this trend highlights its immense potential, which can have far-reaching implications for the future of the economy and the payment service industry.

Additionally, the trends related to security and privacy, as well as demographic changes, are equally crucial for the future application of the digital Euro. These trends fall in close proximity to the green area of the impact uncertainty matrix, which is characterized by the most predominant trends in the market. As such, careful consideration and attention must be given to these trends as they can significantly impact the success of the digital Euro in the payment service market.

Lead Users

Broader Picture: Where Are Lead Users Positioned with Regards to the Diffusion of Innovation?
For a better understanding of Lead Users, it is helpful to position them within the **Rogers´ curve** (E. Rogers, 2003), which is a broadly used model to depict the diffusion of innovation. Lead Users as conceptualized by Hippel are not described by the adoption curve, but rather precede it, as shown by the following figure:

Figure 4. The Position of Lead Users Within the Roger´s Concept of the Innovation Curve (Conradie, 2018)



The reason for this positioning of Lead Users is the fact that while the "innovators" and "early adopters" (as described by the Roger´s model) are the first to adopt new commercially available products or services, Lead Users, in contrast, experience a need for a given product or service **even before it is commercially available** and therefore have to develop a solution for this need themselves. The following figure shows once again that Lead Users have a problem or need to which the general market has not yet found a solution, which is here described as: "producer activity":

Figure 5. Positioning of Lead User Activity with Respect to the Diffusion Curve (Hienerth & Lettl, 2016)

What Are the Characteristics of Lead Users?

To start with, a Lead User can be an individual as well as a company or an organization (Churchill et al., 2009). Quite often, organizations even have "internal Lead Users", which can be employed in the company itself (Schweisfurth, 2017).

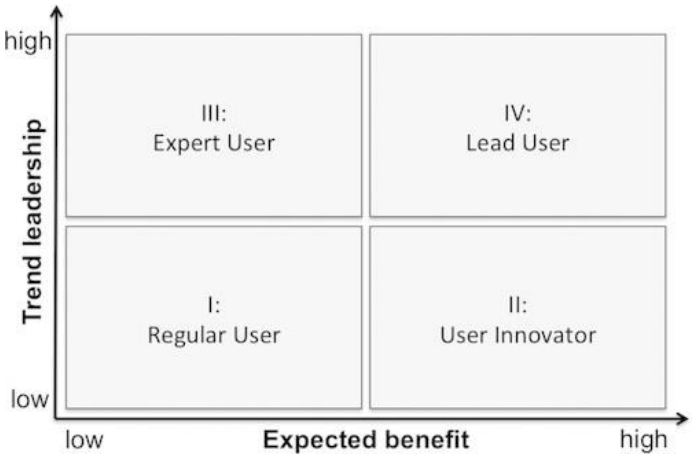
Moreover, Lead Users can be found not only within the target market but also in the analogous markets (Churchill et al., 2009). Furthermore, solutions obtained from Lead Users in analogous markets usually show a significantly higher level of novelty compared to the solutions provided by those in the target market (Franke et al., 2014).

As described by Eric von Hippel himself, Lead Users of a novel or enhanced product, process or service are those who are displaying the following two characteristics with respect to it:

1. they face needs that will be general in a market – but face them months or years before the bulk of that market encounters them, ***and***,
2. they are positioned to benefit significantly by obtaining a solution to those needs (Von Hippel, 1986)

In another words, Lead Users are already now living in the future: they are ahead of the market with respect to a certain trend ("trend leadership") and they have a high expected benefit from solving a given need (Urban & Von Hippel, 1988). These two characteristics explain the position of Lead Users among other user categories as shown by the figure below:

Figure 6. Situating Lead Users Based on the Two Dimensions of the Lead User Construct (Hienerth & Lettl, 2016).



The above-mentioned information about Lead Users raises two questions, namely:

1. How can the two dimensions (trend leadership and expected benefit) be measured?
2. Are there any further indicators relevant for the distinction between Lead Users, expert users, user innovators and regular users?

How Can High Expected Benefit and Trend Leadership Be Measured?

To start with, the dimension of **high expected benefit** is measured above all by self-assessment of respondents, since they are the ones most aware of their needs and possible solutions to them; and the "high expected benefit" refers to a perceived state rather than something which can be found out by mere observation (Hienerth & Lettl, 2016).

Aspects relevant to this dimension are the unavailability of products or solutions as well as the dissatisfaction with existing ones with respect to specific needs or problems that the individual respondent is facing (Hienerth & Lettl, 2016).

Other indicators which might be related to this dimension are peer-assessment, relevant data from the past as well as the respondent´s activities such as conducting research with regard to a given topic (Franke et al., 2006) or even (a move towards) the development of an own prototype (Urban & Von Hippel, 1988).

Secondly, the dimension of **trend leadership** is also commonly measured by self-assessment (Hienerth & Lettl, 2016). In this respect, the following two important aspects need to be taken into consideration:

1. To what degree a **user** perceives him or her as the "leading edge" with respect to the observed trend, and
2. To what degree a user thinks **others** consider him or her as the "leading edge" with respect to the same trend (Hienerth & Lettl, 2016).

However, it is crucial to be aware of the fact that both firms as well as individuals have only a limited ability to self-evaluate their degree of trend leadership objectively and are likely to either overestimate or underestimate their characteristics (Locke et al., 1988).

In order to gain a more objective picture, it is advisable to include additional measures, such as referrals from other knowledgeable individuals in the field (e.g., peers and experts) or, if available, other indicators which point to the respondent´s skillfulness or performance with regard to a certain trend (Hienerth & Lettl, 2016).

Moreover, it is crucial to mention that **trend leadership is both domain- and trend specific**, which means it is not possible to develop a standard measure which would be applicable for all domains and trends (Hienerth & Lettl, 2016). Therefore, it is necessary to find appropriate indicators for a given domain or trend.

Figure 7. A (Self-Made) Overview of the Above-Mentioned Dimensions Characteristic for Lead Users.

Dimension	Measurement	Relevant aspect(s)
expected benefit	above-all **self-assessment**, possibly complemented by: • peer-assessment • data from the past • respondent´s activities (e.g., own research, the development of a prototype…etc.)	Does the respondent perceive a need or a problem that has not yet been solved by the existing products or services or at least not to his/her satisfaction?
trend leadership	**self-assessment,** however, for more objective assessment, the consideration of additional indicators is advisable, e.g.: • assessment from peers and experts	1. To what degree a user perceives him or herself as "leading edge" with respect to the observed trend, ***and*** 2. To what degree a user thinks other consider him or herself
	• respondent´s skillfulness or performance	as "leading edge" with respect to the same trend

Are There Any Further Indicators Relevant for the Distinction Between Lead Users, Expert Users, User Innovators and Regular Users?

Many users innovate (Bradonjic et al., 2019). Lead Users, user innovators and experts are three different kinds of users who can significantly contribute to innovation. However, it is not always easy to draw a clear line between these categories and the following indicators have the purpose to make this distinction easier.

Lead Users -as already mentioned- have not only high expected benefit from a certain innovation (since it solves their pressing problem or addresses a need that is important to them) but also are leading a trend that will be commercially attractive for other users in the future (Schreier & Prügl,

2008) and are therefore involved especially in the early stages of the product development (Von Hippel, 1986). It is also very common that Lead Users possess a high level of expertise in the relevant field (Franke & Shah, 2003). As an example, could serve an innovative automotive company which has a need for e.g., a software which would make a certain production step more efficient and would therefore radically decrease the costs, however, there is nothing on the market, yet which would sufficiently address this need, even though in a few years such a software will be used by the majority of car producers.

Expert users (or "experts") possess high level of expertise and are on the leading edge with respect to an important technological and/or market trend (Hienerth & Lettl, 2016). Even though they are often motivated to make advancements in a given field (Toubia, 2006), their expected personal benefit from a certain innovation is certainly not as high as in the case of Lead Users, which explains their lower innovation activity, at least in the earliest stages (Hienerth & Lettl, 2016). However, such experts often play an important role in the later stages of the innovation process where their expertise is often needed to further optimize the given innovative product or service (Franke & Lüthje, 2020). In this category belong for example industry experts who write articles for professional journals or give speeches at professional conferences and their opinions are highly esteemed and frequently cited (Hienerth & Lettl, 2016).

User innovators are users which might be lacking the expertise in a given field but are dissatisfied with the current standard product and long for a solution which would be tailored to their needs (Hienerth & Lettl, 2016). Producers are sometimes unwilling to come up with a solution which would cater to their personal needs, or their needs have the form of "sticky information" which makes them difficult to communicate (Von Hippel & Katz, 2002) and therefore these users often develop a solution by themselves (Franke & Shah, 2003), which is, however, often not very valuable for a larger number of users (Hienerth & Lettl, 2016). Such is e.g., an innovation of a biker who changes parts of his bike to better fit his or her needs – without any significant implications for other consumers in the future of a given market (Hienerth & Lettl, 2016).

Often, in order to better approach such user needs, producers of a certain product may offer toolkits which enable users to tailor a product a service to their own needs (Von Hippel & Katz, 2002) and thus create added value for customers by better adapting their product/service to the individual needs of the customer (Franke & Piller, 2004). This approach is nowadays used in various different fields, including toys, foods, or financial services (Hienerth et al., 2013).

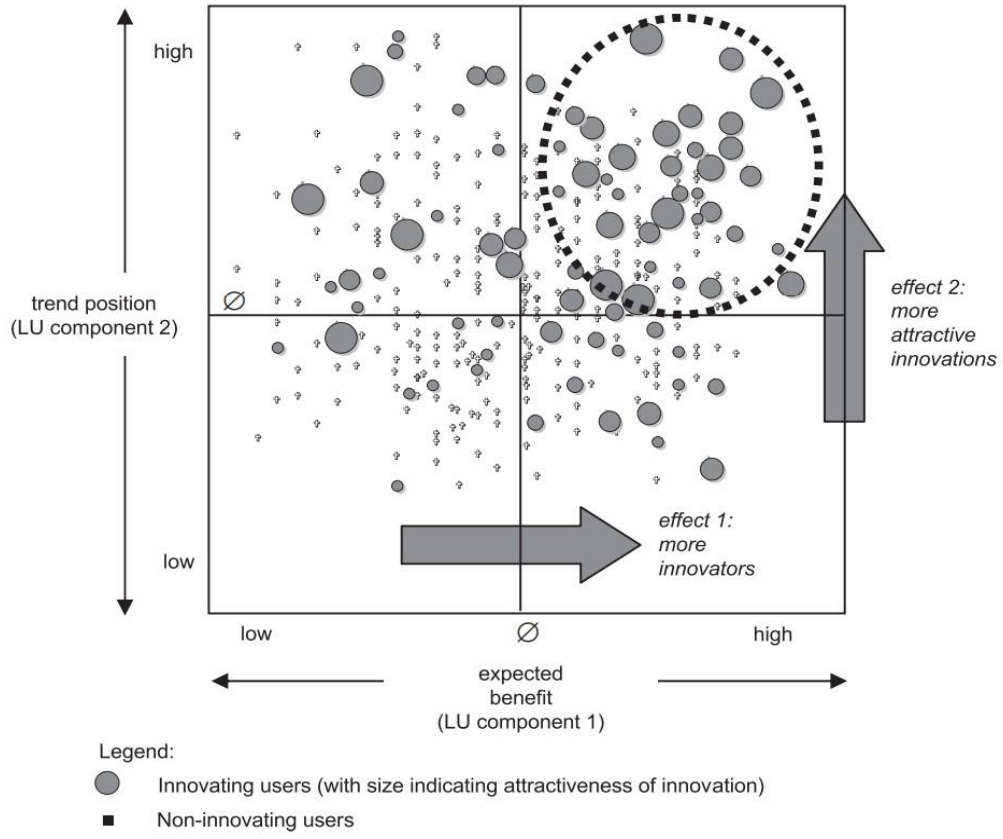
The following table gives an overview of the above-mentioned characteristics of the three distinct user groups:

Figure 8. Overview of the Differences Between Lead Users, Experts and User Innovators based on the above-mentioned description.

	Lead Users	**Experts**	**User Innovators**
Expertise in a particular domain	Often high	high	May be lacking
Motivation for innovation	A need to solve their problem	Advancing their field	Improving their life by creating a solution that (better) fulfills their individual needs
Stages in the innovation process	Usually involved in the early stages, before their need is sufficiently addressed by the market	Often involved in the later stages	often involved in the entire innovation process
Role in the innovation process	Identify new needs and opportunities which are not yet (sufficiently) addressed by a given market	provide technical expertise to optimize a given product/service	from identifying a need to developing a solution

However, it is important to mention that the above- mentioned categorization and characteristics are not to be understood as an absolute, but serve rather as an indication, e.g., it is not true that user innovators have never invented a product or service which would be attractive for other users in the future as well. As the following figure shows, the difference lies more in the average numbers.
In fact, numerous inventions- such as the wheeled suitcase (Wendorf, 2020) - were invented by "simple" user innovators who were trying to make their daily life easier.

Figure 9. Two Components of the Lead User Construct Combined with Empirical Data (Franke et al., 2006)



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II.2 Rankings of the 15 most relevant trends:

Relevance for Target Market				
1,2	1. Lowering Privacy & Data Concerns	1	2	1
4,1	2. Universal Transmission	3	1	8
4,7	3. Cross-Border Transactions	5	5	4
4,9	11. Lack Of Trust In Institutions	2	9	7
5,6	4. Instant Payment	4	3	10
6,3	6. Transaction Fee Aversion	6	9	5
7,1	7. Daily Life Digitalization Of Users (IoT)	7	9	6
7,2	5. Financial Inclusion	9	9	3
7,9	12. P2P Solutions	13	4	2
8,8	14. Identity Verification	8	6	12
10	9. Rising Demand For Digital Wallets	11	9	9
10,4	10. Integration (Into Daily Life Habits)	10	9	12
10,7	8. Capital Preservation	12	7	11
12,2	15. Avoidance Physical Money Issues	14	8	12
12,4	13. Financial Literacy	14	9	12

Bubble size		n_e	n_u	n_l
63	1. Lowering Privacy & Data Concerns	28	12	23
57	2. Universal Transmission	18	33	6
32	3. Cross-Border Transactions	17	4	11
31	12. P2P Solutions	5	5	21
31	5. Inclusion of all people	10	1	20
62	6. Transaction Fee Aversion	16	35	11
26	4. Instant Payment	17	6	3
36	11. Lack Of Trust In Institutions	18	11	7
30	7. Daily Life Digitalization Of Users (IoT)	13	8	9
17	14. Identity Verification	12	4	1
12	8. Capital Preservation	7	3	2
13	9. Rising Demand For Digital Wallets	7	2	4
10	13. Financial Literacy	4	6	0
23	10. Integration (Into Daily Life Habits)	7	16	0
7	15. Avoidance Physical Money Issues	4	1	2

II.3 Online questionnaire results:

Figure II.3.1: Age of survey participants:

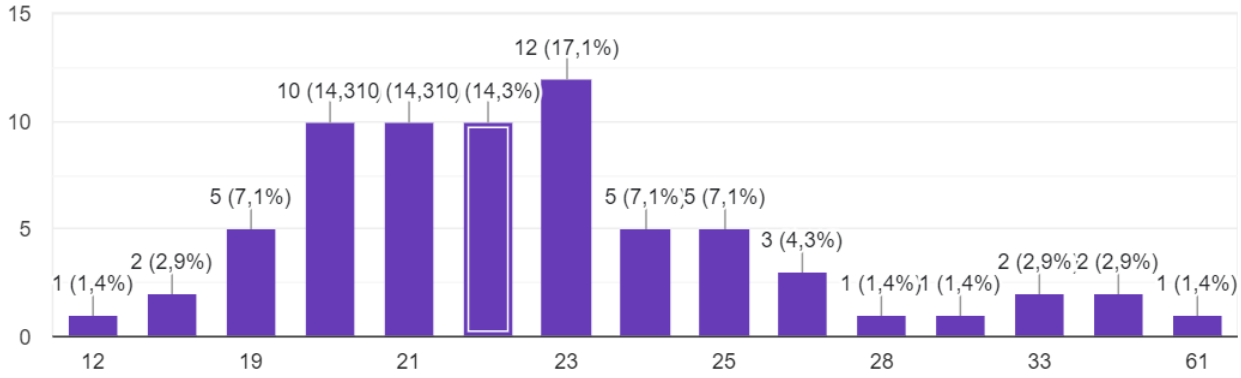


Figure II.3.2: Gender (red: female, blue: male)

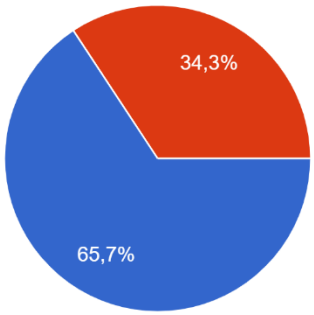


Figure II.3.3: What means of payment do you use regularly?

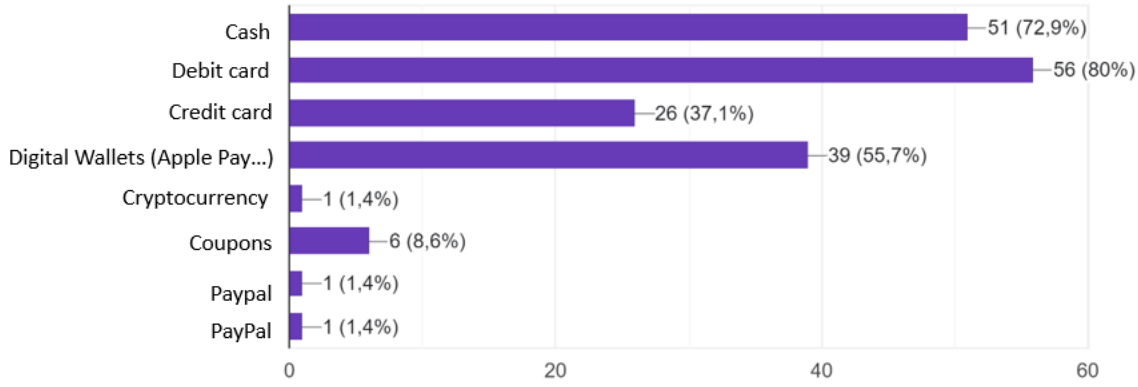


Figure II.3.4: What is your favorite mean of payment?

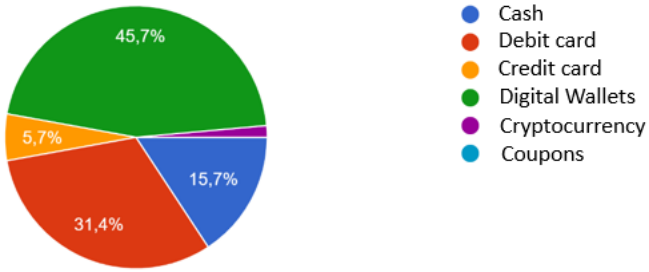
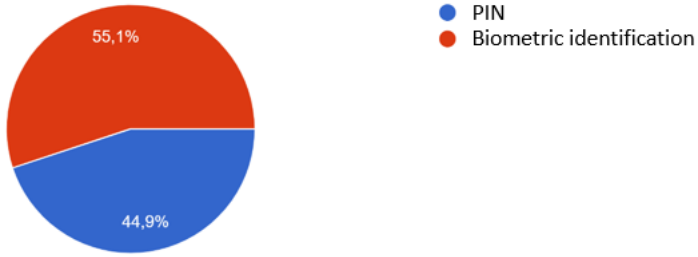


Figure II.3.5: Do you prefer PIN or biometric identification?



Phase III Appendix

III.1. Lead User Matrix Evaluation

How to Evaluate Lead Users by using the Lead User Matrix

1. Introduction

The term "Lead User" was coined by Eric von Hippel in the mid-1980s. Since then, many companies have benefited from Lead Users, especially in the area of product development. The Lead User concept mainly helps marketers identify key customers and develop new product concepts. It also supports innovation management to find essential product attributes and drive product development in a targeted manner. (Hienerth et al., 2007)

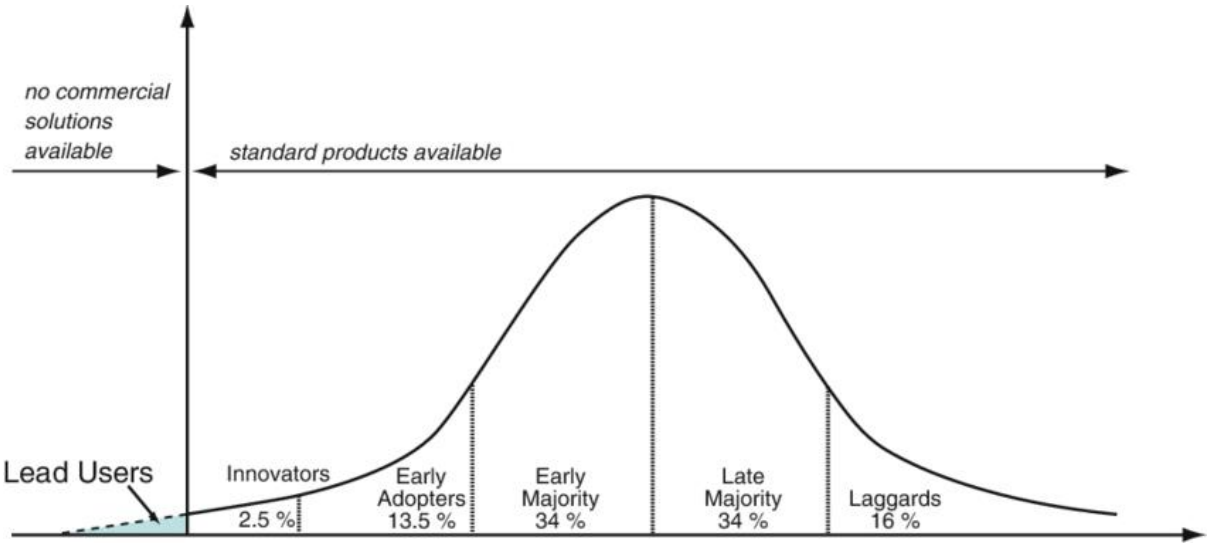


Figure III.1.1: Graphical Representation of the Lead User Theory (Helminen, 2007)

Lead Users are already existing consumers, which have needs that are not yet met nor identified by the producer and, therefore, no commercial solution is made available. Lead Users can be found through "pyramiding", "scanning" and "broadcasting" which were discussed in several papers (e.g. Hienerth et al, 2007). This small fraction of consumers can be found in the target market, but also in the analogous market, which also entail similar needs.

After finding the specific and fitting Lead Users, which can help identify the undefined and unidentified needs of the Digital Euro, also called the Central Bank Digital Currency (CBDC), it is imperative to evaluate the potential Lead Users/experts and filter them out accordingly. In order to evaluate the candidates efficiently and correctly, a tool called the "Lead User Matrix" can be of great importance. This paper will discuss as to how to evaluate Lead Users by using the Lead User Matrix.

2. What is the Lead User Matrix?

The Lead User Matrix, developed by Eric von Hippel, is a conceptual framework designed to assist firms in identifying and evaluating Lead Users for the purposes of innovation. The matrix comprises two dimensions: (1) his/her leading edge position on an important market trend, and (2) his/her level of expected benefit from an innovation. (Hienerth et al., 2007) The former refers to the degree to which the problems experienced by Lead Users are significant and relevant to a wider market, while the latter pertains to the degree to which solutions generated by Lead Users are original and inventive.

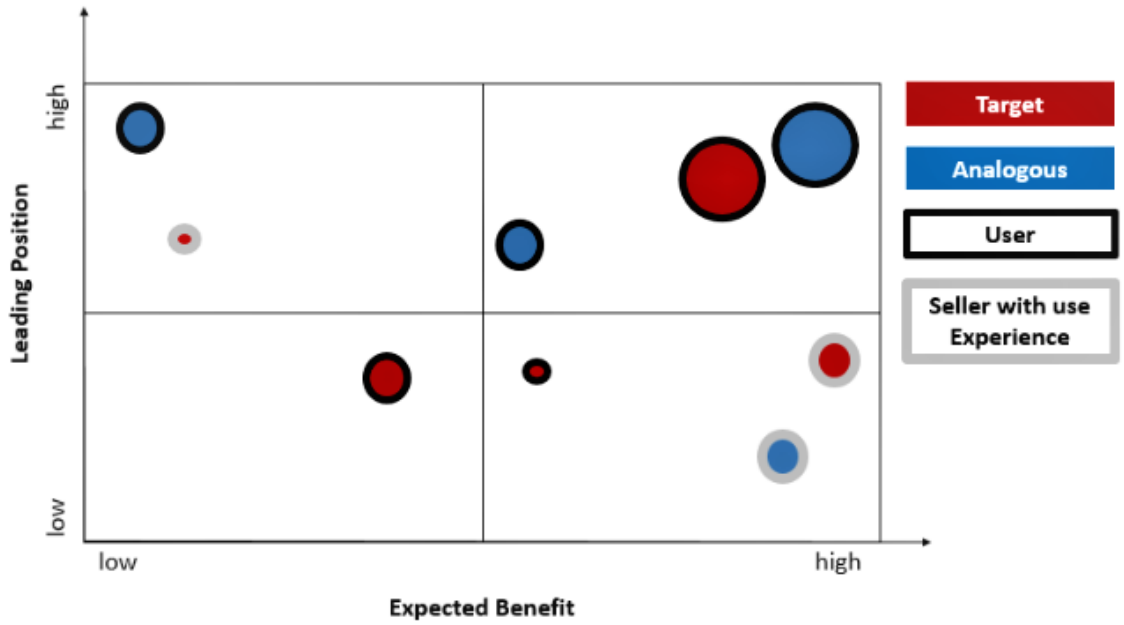


Figure III.1.2 : Lead User Matrix Explained (Hienerth et al., 2007)

The Lead User Matrix is divided into four quadrants, each of which represents a different type of Lead User. In the top right quadrant, Lead Users exhibit both, a high leading position and a high expected benefit, rendering them the most promising candidates for innovation efforts. They generate highly important and innovative solutions to problems that are relevant to a larger market. In the bottom right quadrant, Lead Users display low low positioning but high expected benefit, thereby generating highly innovative solutions to problems that are not yet important or relevant to a larger market, but which may become so in the future. In the top left quadrant, Lead Users enjoy a high leading position, but, unfortunately, have a low expected benefit. They can, however, prove useful in identifying critical problems that necessitate innovative solutions. In contrast, the bottom left quadrant pertains to Lead Users who experience unimportant problems and generate unremarkable solutions, and thus are unlikely to contribute significantly to innovation efforts.

The coloring of the circles, blue and red, represent the market, where the Lead Users originate from, which is either the target market (Red) or the respective analogous market (Blue). The shade of the circles, grey and black, represent the type of Lead Users, which are either users with expertise or its sellers with expertise or significant experience.

As the project partner, the Austrian National Bank, has certain wishes and expectations, the desired trends/categories can be applied in the matrix shown above. Since users of different age groups have different expected/desired benefits, those wishes must be adjusted accordingly. Furthermore, the timeline of the project must be considered as well, as when the study was launched, it was assumed that the payment method might be implemented by the year 2027.

By utilizing the Lead User Matrix, firms can identify and evaluate Lead Users based on their problem importance and solution innovativeness, and focus their innovation efforts on those individuals who are most likely to generate valuable and innovative solutions to important problems.

3. Key Factors

In order to evaluate the identified Lead User accurately, it is imperative to understand the methodology and the sought characteristics of the "perfect" Lead User. First, it is of utmost importance to determine the Lead Userness and the main source of usage. Following, the characteristics of a Lead User are to be evaluated. Those can be separated into three different segments, the person-based characteristics, the market-based characteristics, and the idea-based characteristics.

a.) Lead Userness

In order to determine the Lead Userness, the trend position of that expert/user must be investigated. The expertise and the status of the user in the target market or analogous market must be reliable and sufficient to tackle the problem at hand. Furthermore, the expected benefit or usage of the suggested Innovation must be examined and forecasted accordingly, by comparing the innovation in the user's home market to the target market and how to modify this innovation to be suitable and efficient. (Hienerth et al., 2007)

b.) Main Source of Usage

Another important factor to be considered is the main source of usage. It needs to be determined, how much the innovation can improve overall usage for prospective users and the amount of modification that is needed to integrate the innovation into the target market. If significant or some modifications are needed, the expertise and experience of the Lead User must be assessed. It needs to be assessed, whether the user has had some experience in the modification of already existing solutions or in the development of new solutions for his own, personal use.

Another subpoint that needs to be taken into consideration would be the history of the user in the area of his expertise. To estimate the quality and reliability of the solution, it needs to be determined, if the user has ever sold any of his solutions and its following success. (Hienerth et al, 2007)
Last but not least, the source of the Lead User must be identified. Is the user from an analogous market, which is the market, where an identical trend is playing an important trend and benefits the problem-solving in the target market, some modifications might have to be done. If the user is active in the target market, the newness of the idea/innovation must be considered.

c.) Person-based Characteristics

Lead Users are individuals who have specialized knowledge or skills related to the product or service being developed and are often able to generate new ideas and concepts that are ahead of the curve. To effectively evaluate Lead Users, person-based characteristics are often taken into consideration. (Franke, N. et.al., 2006) These characteristics include expertise, innovation propensity, motivation, proactivity, communication skills, and network centrality. (Lüthje, C et al, 2005) Lead Users are typically highly motivated to solve problems and passionate about the product or service being developed. (Franke, N. et al, 2003) They are often effective communicators who are able to articulate their needs and preferences clearly and persuasively. Lead Users may also have a high degree of network centrality, meaning they are well-connected within their industry or community and have access to a wide range of resources and expertise.
Regarding the selection of Lead Users, specific to the project, the person-based characteristics must be adapted to accordingly. Since the virtual panel discussion is taking place online, certain aspects must be taken into account, such as one's understanding of the usage of online platforms (Teams, Zoom,...etc.). Individuals of an older age group might not be equipped to participate and, therefore, might not be a valuable source in the discussion of improving digital currencies.

d.) Market- Based Characteristics

To locate and determine the suitable Lead User, one must put focus and attention on the market-based characteristics. It is imperative to understand the distance of the target market to the analogous market, as this provides information on the amount of modification needed, as well as the possibility to even implement those solutions.

Market Distance

When analyzing Lead Users, market distance is a crucial factor to take into account since it might affect how relevant and transferable Lead User insights are to the new product or market being produced. (Von

Hippel, E. et al, 2002) The degree of resemblance between the Lead User's market and the market for the newly produced product is referred to as "market distance." A large market distance indicates that the Lead User's market and the market for the new product are quite dissimilar, whereas a low market distance indicates that the markets are somewhat close. (Franke, N. et al, 2003), (Lüthje, C. et al, 2005)

Technical Distance

The technical distance of an analogous market is an important consideration when evaluating Lead Users. Technical distance refers to the degree of similarity between the technology or product being developed and the technology or product in the analogous market. A high technical distance means that the technology or product being developed is significantly different from the technology or product in the analogous market, while a low technical distance means that the technologies or products are relatively similar. (Von Hippel, E., 1986)

The importance of technical distance lies in its impact on the relevance and transferability of Lead User insights. Lead Users from an analogous market with a low technical distance can provide valuable insights into the design and development of the new technology or product being developed. For example, Lead Users of a similar product in a different market can provide feedback on features, functionality, and user experience that can inform the development of a new product.(Bakker, S. et al, 2012)

However, Lead Users from an analogous market with a high technical distance may not be as relevant or transferable to the new technology or product being developed. In this case, their insights may be less valuable or require significant adaptation to be useful.

In addition, technical distance can also affect the degree of risk associated with adopting Lead User insights. High technical distance can increase the uncertainty and risk associated with implementing Lead User insights, as there may be more unknowns or challenges involved in adapting insights to the new technology or product.

Overall, evaluating the technical distance of an analogous market is important in determining the relevance and transferability of Lead User insights, and in assessing the degree of risk associated with adopting these insights. By carefully evaluating the technical distance, businesses can identify the most valuable and relevant Lead Users and develop strategies to effectively leverage their insights.

e.) Idea Based Characteristics

Lead Users can be evaluated based on idea-based characteristics that focus on the innovative ideas and concepts they generate. These characteristics include the novelty, usefulness, feasibility, scalability, and compatibility of the ideas generated by Lead Users. (Von Hippel, E., 1986) Lead Users often generate ideas that are unique and ahead of the curve, as well as useful and applicable to a wide range of users and use

cases. Their ideas should also be feasible and scalable, with the potential to be implemented on a larger scale. Compatibility is also important, as the ideas generated by Lead Users should be compatible with existing technologies, infrastructures, and user behaviors. By identifying Lead Users who generate innovative ideas and concepts that possess these idea-based characteristics, firms can more effectively harness their creativity and expertise to develop new and innovative products and services.

4. Analysis and Evaluation of Lead Users

The actions listed below should be taken by a business to analyze Lead Users using the Lead User matrix (Von Hippel, E., 1986):

Step 1: Determine prospective Lead Users depending on their degree of knowledge and inventiveness. This can be accomplished by user surveys, market research, or analysis of user-generated information from websites like blogs, forums, and online reviews.

Step 2: Using the Lead User matrix, classify the identified Lead Users according to their leading edge position on an important market trend and skill.

Step 3: Choose the most knowledgeable and innovative Lead Users for further analysis. These Lead Users are more likely to have creative ideas that can be added to the business's goods or services.

Step 4: Engage with the chosen Lead Users to learn more about their requirements, preferences, and ideas is how a corporation should evaluate Lead Users utilizing the Lead User matrix. Interviews, questionnaires, or asking them to co-creation workshops can be used to do this. Project-related key aspects must be taken into consideration as well.

Step 5: The Lead Users' ideas and solutions are evaluated, and the most promising ones are chosen to be implemented into the company's goods and services.

5. Conclusion

A useful tool for assessing Lead Users and locating creative concepts and solutions is the Lead User matrix. Companies may efficiently identify and interact with lead consumers to obtain a competitive edge in the market by using the assessment procedure described in this research. The Lead User matrix is simply one of several tools, such as the automated identification of different Lead Users, that businesses may use to assess Lead Users; as such, it should be used in concert with other techniques to guarantee a thorough review. (Schmid et al., 2022)

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III.2. Alternatives to pyramiding

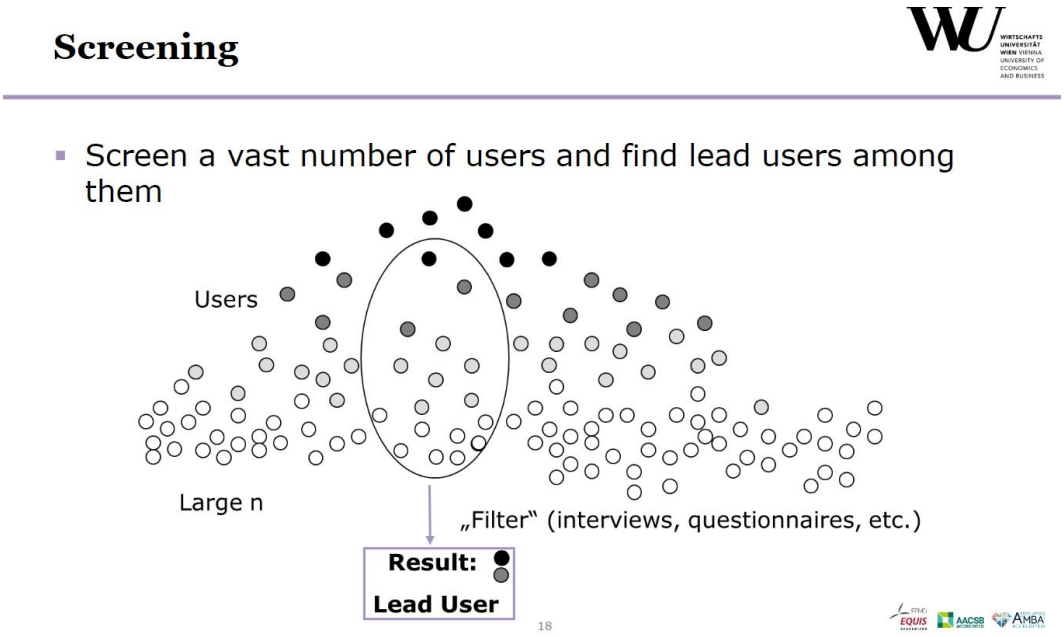

Figure III.2.1: Screening interview method
Internal Presentation (2023), Institute for Entrepreneurship and Innovation, Vienna University of Economics and Business

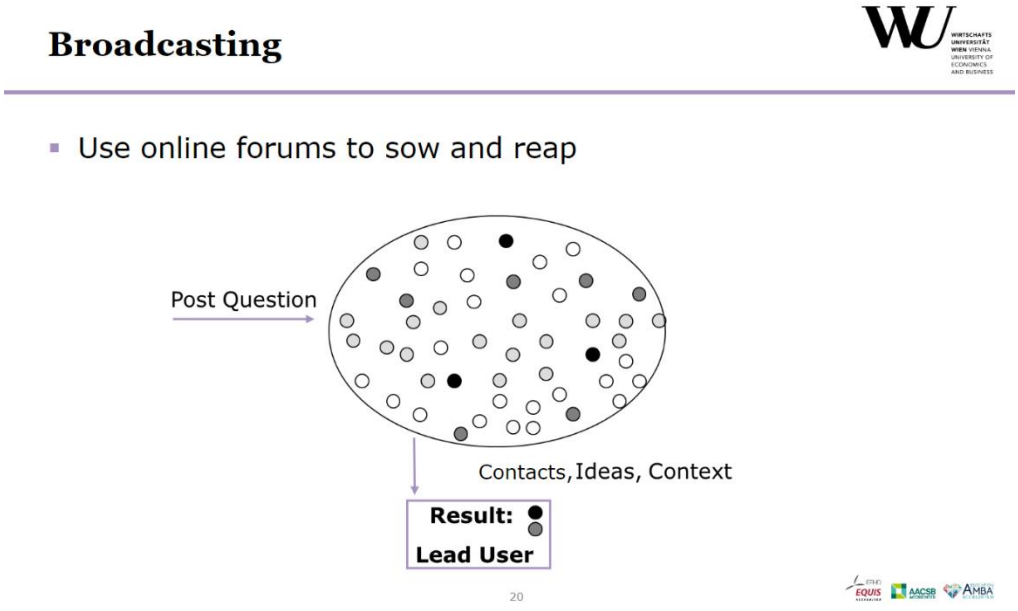

Figure III.2.2: Broadcasting in online forums
Internal Presentation (2023), Institute for Entrepreneurship and Innovation, Vienna University of Economics and Business

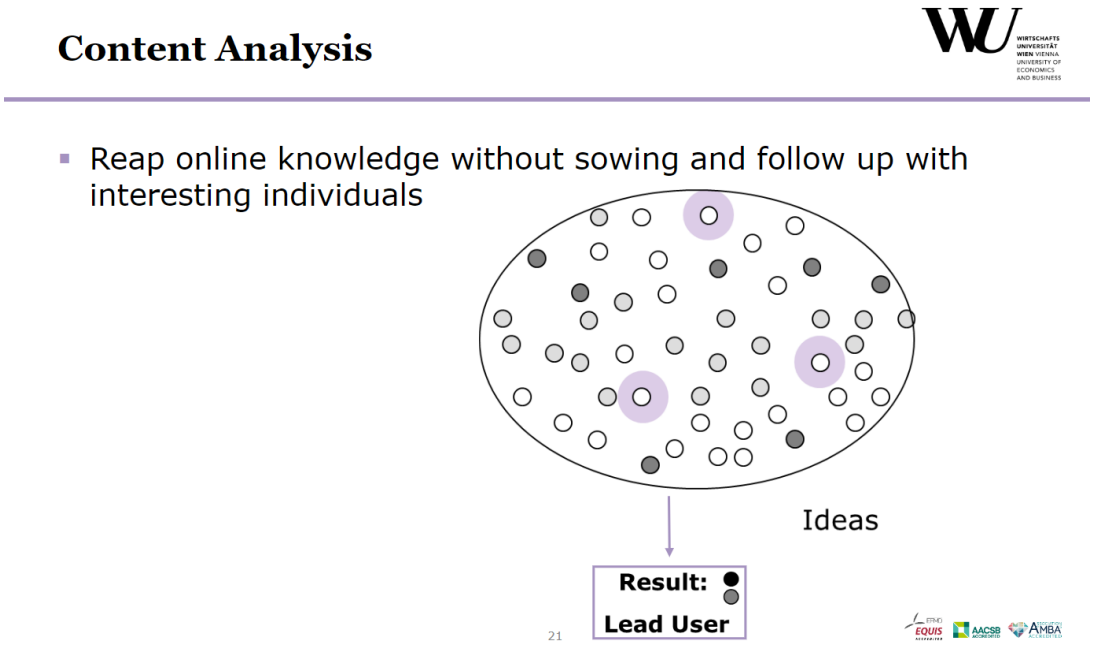

Figure III.2.3: Content Analysis in online forums
Internal Presentation (2023), Institute for Entrepreneurship and Innovation, Vienna University of Economics and Business

III.3. Wallet Function as a possible solution

- Most of our Interview partners were already acquainted with the presented functions, as they are common practice in within specific segments and that they are possibilities however nothing which presents a radical innovation.
- Wallet with a card for easy payments everywhere (supermarket, pharmacy, etc.)
- Ability to do taxes over the app.
- Developed by the Central Bank (CB) but implemented into private bank apps.
- Two wallets: personal wallet and business wallet controlled by the bank.
- Business wallet functions like a bank account, shared between the user, bank, and third parties.
- CB has access and flexibility over the money.
- Digital wallet should be memoizable on a digital device.
- Offline functionality using Bluetooth or NFC for proximity-based transactions.
- Consider using inexpensive devices or firmware for secure transactions.
- App should be user-friendly, potentially with a physical device similar to a calculator.
- Implement an offline solution inspired by AirDrop or similar technology!
- Debit card functionality with existing infrastructure for device payments
- Create a smartphone app for digital, touchless payments.
- Explore the possibility of conducting transactions through messages or satellites.
- Utilize the European Space Agency for payment solutions.
- Consider wearable devices like wristbands for convenient street transactions.
- Look at Australia for relevant examples or insights.

III.4. Suggested Solutions by Interviewees

III. 4.1. PRIVACY AND DATA CONCERNS (increased awareness and usage from people)

- Salaries can be partly provided in digital Euro.
- Famous people can start using the Digital Euro and promote its usage (celebrity marketing)
- Effective advertising campaign, detailing the process and the digital Euro on the website, and at launch if the central bank were to go on television, it still needs to reassure people about privacy.
- Debunk some false things related to the topic.
- Leave data to the user like on the blockchain (push the marketing on saying the transactions are encrypted) and get data encrypted. For this, if necessary for criminal identification reasons, there will be the need of a warrant like for the police (Mentioned multiple times).
- "Happens every time with new digital businesses. One should use "stick and carrot". People are paying with their data always, therefore if they feel that they gain more than what they give up, they will be more involved in using the digital Euro regardless of the privacy (tradeoff). People tend to forget these things fast (think of the data agreements everyone accepts without reading). Something they can get only with the digital Euro, without alienating late adopters (you cannot make enemies)."
- Offer cashbacks or other incentives like easy access to "something"
  On larger scale (gambling companies) you can receive free money, hence giving free money to use on specific expenses.
- A too high degree of data verification lowers trust and that it is therefore necessary to adjust the level of verification depending on the amount of payment, which is a common practice for businesses (e.g., minimal verification under e.g., 1.000 EUR and intensified verification for bigger sums of money

III.4.2. DAILY LIFE INTEGRATION

- As an alternative to relying on a private system, it might be useful to have a platform on a government site through which people will have access to their own information. Moreover, the website could offer additional advantages.
- It should be done by leveraging private channels (you can withdraw your pension without having a postal account by going to the post office and picking up the envelope with the money) (Italian example)
- Focus on international transactions, as they are very time consuming.
- Warning: If we create something completely new, it becomes difficult to use (network effect)
- Using a vinted-like app that will combine cbdc holding and access to government bonds – this would increase use as it would have more functions.
- Digital wallets in combination with an own digital identity make authentication easier and increase the user-friendliness. This could be done based on zero-knowledge technology, otherwise such a concentration of data in one place can bring serious risks for privacy.
- A good inspiration is MakerDAO https://makerdao.com/en/, which is an autonomous decentralized ecosystem which also includes digital wallets.
- Interoperability of the digital Euro with other existing protocols (e.g., Ethereum) may help with the integration Into Dailyhabits.

III.4.3. UNVERSAL TRANSMISSION

- Use of a Cold wallet
- Do transactions through hardware (e.g., hard disk with key password)
- Offline: processing data during closed hours (similar system of the current one) but available like this 24/7, as processed in the same environment
- To have access to the digital Euro, one needs access to a digital platform (which means homeless people will inevitably be excluded). Unless you provide any European citizen with a tool one can use to use digital Euro
- Yet, there must be some hybrid version between cash and digital payments (this is however a political issue)
- In computer science there is batch processing/computing (huge amount of offline data processed in a system/gather data offline to then upload the data once online) Wallet with a card for easy payments everywhere (supermarket, pharmacy, etc.)
- Ability to do taxes over the app.
- Developed by the Central Bank (CB) but implemented into private bank apps.
- Two wallets: personal wallet and business wallet controlled by the bank.
- Business wallet functions like a bank account, shared between the user, bank, and third parties.
- CB has access and flexibility over the money.
- Digital wallet should be memoizable on a digital device.
- Offline functionality using Bluetooth or NFC for proximity-based transactions.
- Consider using inexpensive devices or firmware for secure transactions.
- App should be user-friendly, potentially with a physical device similar to a calculator.
- Implement an offline solution inspired by AirDrop or similar technology.
- Debit card functionality with existing infrastructure for device payments
- Create a smartphone app for digital, touchless payments.
- Explore the possibility of conducting transactions through messages or satellites.
- Utilize the European Space Agency for payment solutions.
- Consider wearable devices like wristbands for convenient street transactions.
- Look at Australia for relevant examples or insights.
- Offline: Use a sticker with an NFC chip or a QR code
- Connect the digital Euro account with the user’s phone number. Through that, one can send money easily (also offline).
- Making use of existing stablecoin infrastructure. Even Société Générale (one of the biggest European Banks) has worked on its own stablecoin.

III.5 List of Forums Accessed for Phase III

#	Forum Name	Forum Link	User in the forum
1	ResearchGate	https://www.researchgate.net/	
2	Reddit/AskAcademia	https://www.reddit.com/r/AskAcademia/	
3	The Chronicle Forums	https://www.chronicle.com/	
4	Quora	https://de.quora.com/	
5	LinkedIn-Pro	https://www.linkedin.com/	
7	Meetup	https://www.meetup.com/	
8	Warrior Forum	https://www.warriorforum.com/	
9	Gutefrage	https://www.gutefrage.net/	
10	Indie Hackers	https://www.indiehackers.com/	
11	Product Management Insider	https://www.hugedomains.com/domain_profile.cfm	
13	Bitcointalk	https://bitcointalk.org/	
14	Reddit/r/CryptoCurrency	https://www.reddit.com/r/CryptoCurrency	
16	Bitcoin Stack Exchange	https://bitcoin.stackexchange.com/	
18	Data Science Central	https://www.datasciencecentral.com/	
19	Privacy Tools	https://www.privacytools.io/	
20	Reddit/privacy	https://www.reddit.com/r/privacy/	
21	Hacker News	https://news.ycombinator.com/	
22	Finextra Community	https://www.finextra.com/community	
23	Reddit/Fintech	https://www.reddit.com/r/Fintech	
24	FinTech Forum	http://www.fintechforum.de/	
25			