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Digital EURO: The Impact of Digital Currency on Startups

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Abstract
Digital Euro, and other Digital Currencies, are based on blockchain technology and blockchain blended with new disruptive technologies of IoT. Besides, AI introduces a new thinking method into the startups' business models. Thus, this paper presents this thinking method. Besides, the paper illustrates how a 'Programmable Digital Euro' integrated into existing processes of retail banks can provide new prospects for startup businesses. The underlying discussion is based on a critical review of the prevailing body of evidence. The report illustrates that the startups will be affected by the introduction of Digital Euro. The effect might be positive or negative, or even both. Nevertheless, the nature of the effect will largely be determined by the laws set in place to govern startups. Perhaps the most influential laws will provide a platform for startups external to the EU to assert their authority. The onset of the Digital Euro will spur investment while allowing the startups, especially those that focus on technology, to excel in the European market. Other than the government support and facilitation, the tech-based startups will use IoT, AI, and blockchain strategies to develop novel and innovative investment ideas. The underlying model will systematically blend all these technologies to yield the anticipated benefits in the EU market. The model will comprise key partners, activities, resources, customer relationships, channels selection, customer segment, and cost structure. All these aspects, if integrated effectively, will foster optimal success for the startups such that they assert their authority even in the face of well-established industry players.

Keywords: Digital Euro, Startups, Digital Currencies, Blockchain

Report on a Digital Euro

1. Introduction

New technology is an important source for startups to generate ideas for their own business. The already technological revolution led by IoT, AI is about to be combined with disruptive technologies such as blockchain. The synergy of these technologies will dramatically reshape the current economic environment and will create new business opportunities for startup businesses. Indeed, the speed of innovation has led to increased preference for digital payment by citizens, and thus Central Banks like the European Central Bank (ECB) plan to enter the digital currency world, for example Digital Euro in the euro area.

Although digital currencies will not replace other forms of payment but will complement them, it is important for the startup stakeholders to understand these new concepts and use them to build new business models. In other words, Digital Euro or any other Digital Currency is associated to blockchain technology and blockchain combined with new disruptive technologies of IoT, and AI introduce a new thinking method into the business models of the startups. In this paper we present this thinking method and how a 'Programmable Digital Euro' integrated into existing processes of retail banks can provide new prospects for startup businesses.

2. Reasons to Issue a Digital Euro

The main business driver of the ECB is the digital transformation and autonomy of the European economy making Euro more accessible to businesses and consumer users. ECB aims to establish a digital currency which replicates the current form of euro and its associated backend infrastructure but allow new business opportunities and use cases for startups or already established businesses, consumers if the digital currency is integrated in their payment and business processes. Facing competition from the digital currency of other countries (e.g. China) or organisations which are also launching digital currencies, a Digital Euro currency would promote the sovereignty of the Euro while also contributing to the growth of innovative ideas on European industries (BitCom, 2020).

Also the drop in the usage of cash shows that there is an increased reliance on alternative forms of payment in the euro area. A digital euro would serve as a complementary form of payment and should match to key features of cash like permitting offline payments, easy for use by vulnerable groups, free of charge for primary uses and guaranteeing privacy (BitCom, 2020). Additionally, any circulation costs have to be minimum and it should guarantee the privacy of end users and businesses data, and its efficiency allowing fast payments.

Thirdly, introducing a digital euro will create an alternative for the euro-dominated central bank money, commercial bank deposits, and electronic money. The digital euro would also create a reliable alternative form of exchange and also store value on the euro area. A digital euro would prevent private entities that are not supervised by European financial authorities from developing payment solutions for the euro area thus posing risks like foreign exchange risk and also threaten the European financial independence. Issuing out a digital euro will promote European autonomy, especially with regard to monetary and financial aspects (Ferrari, M., Mehl, A., and Stracca, L. 2020). The requirement for this benefit is that the digital euro should have features that are quite similar to the payment solutions offered by foreign private entities.

Another reason for issuing the digital euro is that the chances that issues like cyber-attacks, natural calamities, pandemics or other major events could affect payment services, need to be

reduced. Various risks could limit the use of online banking and cash withdrawals from Automated Teller Machines (ATM) thus affecting retail payments and reducing the citizens' trust in the financial system. Having a digital euro that is used together with cash would constitute a contingency plan that would ensure that electronic payments methods are still functional even when private solutions fail to function. This requires that the digital euro should be transacted via strong channels that are different from other payment solutions and that can also persevere major events. The final reason why it is important to issue out a digital euro is that it promote the international role of the euro and stimulate the use of the euro by foreign investors (ECB. 2017). This advantage requires that the digital euro should be made available beyond the euro area in a manner that is still in line with the goals of the Euro-system.

3. Digital Euro Functional Design Possibilities

There are certain features that are essential to a digital euro and one of these is access; in that users could either access the digital euro directly or they could also do so indirectly by way of supervised intermediaries. Second is privacy which can be guaranteed by making it such that the system operator could allow only specific kinds of transactions to go through without recording the identities of the parties. However, some types of transactions would require that the identities of the parties be recorded as per the rules. The third feature would be preventing the digital euro from being used as a means of investment thus avoiding shifting commercial bank money into digital euro. This would be done by keeping within a certain range the amount of digital euro that an individual can hold. The fourth feature is that the digital euro would prevent the access of the individuals or entities that can access its services. This would mean that the use of the digital euro would be limited to residents in a certain jurisdiction thus avoiding problems associated with international use like financing terrorist activities. Having restricted access for the digital euro would mean that it could still be used internationally by specified groups that are not members of the European Union like for instance when members of such countries visit euro area countries.

The digital euro will also need a transfer mechanism which could either be an account-based system or a bearer instrument. An account-based system works by enabling a third party to record the user's holdings and then ascertain for the payer and the payee if the transaction is valid. On the other hand, the bearer instrument works by letting the participants who are the payer and the payee take responsibility for confirming any transfer of value between them. When it comes to the device used for payment, a digital euro could be issued as a web-based service or by way of specific physical services like smartcards. A digital euro could also be issued through the web-based service and the physical device, to the extent that the two payment solutions are synchronized. Another feature of the digital euro is that it should be available for use offline so as to avoid the transaction details of the payer and the payee from being shared with other people other than themselves, to enable the digital euro to work together with cash and also to provide a back system for payment services in case of extreme situations like natural disasters. The digital euro would also need to allow for remuneration for monetary policy reasons, financial stability and structural reasons, like lowering the need to use the digital euro for purposes of investment and preventing the Euro system from becoming a huge investment liaison.

4. Technical and Organizational Approaches to Digital Euro Services

There is need to look at the specific design choices for the technical execution of a digital euro at the level of the back-end infrastructure, and end-user access solutions. Issuance of a digital euro should always be controlled by the Euro system. Intermediaries who are supervised by the central bank should only be involved when it comes to identifying entitled users and maybe for directing transactions to the central bank infrastructure. There are two different approaches that can be considered for the back-end infrastructure: centralized and decentralized. The centralized approach works by ensuring that the digital euro transactions are recorded in the Euro system's ledger. In the decentralized approach, the Euro system establishes the rules and regulations for the settlement of digital euro transactions which are then recorded by users or intermediaries who are under supervision. On the other hand, end-user access solutions link end users to the back-end infrastructure and thus they are very reliant on the infrastructure model chosen. The Euro system would need to ensure that different end-user access solutions are integrated so as to make digital euro services available globally and also so that the digital euro services can operate together with the financial market ecosystem.

5. Disruptive Technologies of IoT, AI and Blockchain for Digital Euro

5.1. Internet of Things

The Internet of Things now includes more than 20 billion of small devices designed to detect, collect, send data, and execute commands over the Internet. Such information may include location, contact list, browsing patterns, and information about our health and fitness. Data detection, collection and dissemination is done through standard wireless communication protocols. Devices receive sensing data from the environment and can also adapt to it or inform people to make personalized decisions.

Specifically, the Internet of Things (IoT) is an innovation that has penetrated the daily lives of industries and households. It refers to the internet connection of everyday objects, which have the intelligence to be able to connect to any wireless network and environment by detecting, collecting, sending data and executing commands via the internet. It aims not only to increase the ubiquity of the Internet, but also to create a distributed network of devices that communicate with people as well as other devices. Thanks to the rapid developments in related technologies, the IoT offers valuable opportunities for a large number of new applications that promise to improve the quality of human life and facilitate the exchange of services (Jayavardhana et al, 2013).

Over the past decade, the IoT has penetrated everyday life, thanks to the availability of wireless communication systems (e.g. RFID, 5G, IEEE 802.15.x), which are increasingly used as technology guides for smart surveillance applications, and control. Many leading manufacturers, service providers, and software and systems developers are investing in the future global vision of the IoT. In fact, different IoT implementations may adopt different processing and communication architectures, technologies and design methodologies, based on the target framework. Examples of IoT application scenarios include medical equipment for patient monitoring, cars connected to vehicle networks, monitoring devices, portable sensors, smart home systems, and so on. In such a context, it is essential to determine how stakeholders can communicate effectively and exchange information with each other and with remote servers.

The term "Internet of Things" is widely used to broadly define a future reality in which objects equipped with sensory and activating capabilities are connected to a global network infrastructure capable of bridging the gap between physical and digital things. An IoT system can be represented as a collection of intelligent devices that interact collaboratively to accomplish a common goal, obtain data from and act in the environment in which they are located (Lee and Lee, 2015).

5.2. AI and Machine Learning

AI is a revolutionary technology which supports innovative applications such as robotics, autonomous vehicle systems, product recommendations, spam filters and navigation system (Deloitte, 2020). One of the core technologies in AI is machine learning (ML). ML algorithms are applied to data in the form of clustering, classification and regression and can be divided into supervised and unsupervised (Athey, 2018). Some of the techniques of supervised machine learning are Concept Learning, Decision / Classification Trees, Rule Learning, Neural Networks, Bayes Learning, Instance Based Learning, Support Vector Machines. In unsupervised learning the system is called upon to explore data and create patterns that emerge from the correlations or groups that exist in the data. Used in association analysis and clustering problems (P. Dangeti, 2017).

In grouping problems the data should be divided into clusters. The separation must be done in such a way that those elements that have several similarities to each other belong to one group, and the elements that are quite different to each other belong to different groups. The differences between the data are measured by various metrics and criteria. Grouping algorithms belong to the categories of partition based algorithms, hierarchical algorithms, probabilistic algorithms. Reinforcement learning techniques are used in planning problems, where the goal of the system is to find a sequence of actions to lead to an already well-known final state - goal.

5.3. Blockchain

A blockchain is a series of blocks that are connected to each other, where the last block is connected to the previous one and so on. This distributed ledger utilizes cryptographic techniques, which add timestamps to the information stored in the distributed system. Thus this is shielded from fraudulent or central control attempts as the processing power of the blockchain is secured by many different nodes (Wander, 2020).

Each block contains a header and a body. The body contains the transactions of this block. The block header contains a hash value that points to the previous block header. Adding the hash value of the previous block to a new block creates a chain. The header also contains the time stamp of its creation, a random number and the value - root of the fragmentation of the individual transactions in the body of the block. A random number (nonce) is an arbitrary number that is used once. Each block is a group of information and when a node creates a block, it will try to add the block to an existing blockchain. The other nodes are asked to verify each new block before adding it to the chain. When the block is validated, the nodes confirm its acceptance by extending the chain. The algorithms used to manage verification and consensus across multiple entities may be different for each blockchain application.

Blockchain technology offers different possibilities, but the main benefits of technology are the ability to mitigate the need to mediate the transactions of a trusted third party. Transactions between companies or individuals always require a certain level of trust. In today’s world people trust the good name of a company or the certifications of individuals. Blockchain offers

an alternative, transferring the trust required by an entity to the technology itself. In short, blockchain is a sharing book that provides a consensus mechanism with some degree of anonymity and privacy on an unreliable network. Blockchain technology can also be the basis for concluding "smart" contracts that allow transactions with different types of validations and for which verification takes place in a transparent system. What is achieved is that the transactions are unchanged and it is not possible to alter a record related to a transaction (Tavares, 2018).

The main benefits of technology are the following (Geranio, 2017):

- Avoidance of mediation: the parties involved have control over the information and two entities can exchange without the need for the mediation of a trusted third party.
- Integrity: the execution of transactions is based on protocol. They can be analyzed and made available at any time to all parties involved in a transparent manner.
- Quality data: the data in the blockchain is complete, consistent and unchanged.
- Reliability: Blockchain uses a distributed network. This eliminates the need for a central point of mediation which is usually a central point of error and attack that affects the whole system.

On the other hand, Blockchain is a technology that has many challenges. The speed of a transaction, the information limit that each block can contain, and the verification procedures need to be validated in different real-world scenarios for the technology to be widely accepted. Depending on the consensus trading algorithm used between the parties used, a distributed encrypted trading log may require a lot of computing power. Regarding the control, security and protection of information confidentiality, further research is needed, because, although all data can be encrypted, the data is disclosed, and if the encryption protocol is violated, then the information will be exposed (Tavares, 2018).

In order for this technology to replace existing trading systems, it is necessary to overcome at least system interconnection issues, changes in the mode of operation and culture of organizations and lack of legislation. System interconnection issues exist because blockchain application solutions require significant changes and, in most cases, complete replacement of current systems. It is necessary for the parties involved to organize and define a strategy for the development of the required technologies. Changes in the way organizations operate depend on the resilience and strength of current blockchain applications. Most people see technology as something new but not necessarily a revolution, and there is some skepticism about the true potential of the blockchain. In addition, changes in technology and therefore widespread adoption of blockchain technology, require legislative incentives. Although blockchain promises to solve the problem of intermediary of trusted entities in a transaction, it is still required that the authorities resolve by legal means any dispute that may arise (Fabiano 2017).

6. Programmable Digital Euro – Benefits for the Startups

A European retail central bank-backed digital currency (Retail CBDC) in the form of “Programmable Digital Euro” will bring new opportunities for businesses and users. Especially, European startups will have access to new initiatives such as faster cross-border payments, automation, real time micropayments and others while being protected by European legislation especially against the sovereignty in the digital economy. Euro’s CBDC will also drive evolution of the traditional banking transactions into P2P or machine-to-machine transactions,

faster exchange rate settlement or interest rate risk calculations. Banks' operating and management processes will become more efficient and provide added values to businesses and consumers.

Cross-border payments and trade finance will become cheaper and faster. Currently, the transaction fees for cross-border payments may reach 7% of the transaction value and may take up to ten days to be cleared (World Bank, 2018). According to the European Central Bank's 2019 statistics on non-cash payments, around 45 billion transactions were processed by retail payment systems in the euro area worth €35.0 trillion. It is estimated that around 3 billion euros of capital costs could be saved by real-time payments (European Central Bank, 2019).

The digitalization of the machine economy (Industry 4.0) and the invasion of Internet of Things to logistics and payment systems will contribute to unifying logistics, supply chain and trade finance to one system. Startups will have day-one access to automated, cloud-based supply chain systems having the flexibility of using adaptive logistic networks connected to payment networks in real time. The Digital Euro – empowered blockchain platform will provide a security layer across production (Industry 4.0), storage, delivery (logistics) and payment. Startups should consider that AI technology allows more and more the use of autonomous IoT machines in various sectors (e.g., transportation, healthcare, manufacturing, etc.) which will have the capability of conducting payments autonomously. IoT machines will have access to a blockchain-protected digital account to be able to make these payments using their own identity. Startups will also benefit from further innovations in the financial sector and capital markets due to the Digital Euro. Payment flows for funding or payments to clients and suppliers will be further automated and will include new means of payments (e.g., coupons, dividends, repos). Security or foreign exchange trading will be instantly settled due to concurrent execution of blockchain-based digital amount transfers. The hardware and software solutions associated to Digital Euro should allow new means of payment (e.g. digital wallets, or mobile) except the standard e-banking services of retail and commercial banks (BitCom, 2020). Startups in the financial industry either promoting their services as intermediaries or payment service providers are facilitated by the legislative framework of a Digital Euro-related payment system across the EU (CRR, PSD2, MiCA, DGSD and EMD2 regulations across EU).

The above benefits will help the European startups to lead the way towards new business models which combine Europe's new Retail CBDC with disruptive technologies of AI, IoT and Blockchain.

7. New Business Models for Startups

In this section we propose three examples of new business models that Digital Euro will pave the way for new startups.

7.1. Smart Contracts

Since blockchain can help automate industrial processes involving many organizations, it is important to define the concept of smart contract: a computer program that executes agreements entered into between at least two parties, causing certain actions to occur when certain conditions are triggered, or specific conditions are met. Thus, when such conditions occur, the smart contract automatically acts accordingly clause. In this way, the software program can translate the control of physical or digital objects into legal terms.

The terms of a smart contract are based on data that depends on external services that take data from the real world and store it in the blockchain (or vice versa). Such services are referred to as ledgers. For example, a ledger could inspect files to determine if an item has arrived so that arrival information is recorded in the blockchain. In this case, the smart contract can activate a series of program commands depending on the conditions and input data.
Depending on the type of information collected and the interaction with the outside world, there are different types of ledgers based on how it is implemented: software program, hardware, incoming and outgoing message oracle, and consensus-based oracle. The software program handles the available electronic information. Examples of such information could be the temperature of a stored product, the price of spare parts purchased or the location of the trucks or other information on supply chain processes. The data comes mainly from websites and is collected by the ledger software, which extracts the necessary information and pushes it into the smart contract.

The ledger material is intended to extract information directly from the physical world. For example, RFID sensors are a potential source. The biggest challenge for hardware ledger is to report input values without compromising data security and to ensure that reading the values corresponds to a specific physical process. Incoming ledgers introduce information from the outside world (that is, from sources of information that do not interact with the blockchain) into the blockchain (e.g., the price of an item that can be purchased automatically when it reaches the desired price). Conversely, outgoing information ledger allows smart contracts to send information to the outside world (e.g., when it is confirmed that a set of components has been received correctly, payment money can be released automatically). Consent-based ledgers combines different ledgers to determine the outcome of an event.

7.2. Sharing economy

One example of a new business model related to the sharing economy model is the sharing of self-driving cars. Although the use of autonomous vehicles is still at research stage, startups can consider them as a new resource which may offer the potential advantage of providing related services (e.g., owners of self-driving cars offer them as taxi service for exchange of digital money). Using a blockchain platform no third party needs to be involved to the transaction.

7.3 Health care applications

Medical and healthcare service applications can be provided remotely based on specialized IoT equipment which measures important life keeping data (e.g. blood pressure, glucose, oxygen) or diet data. The data can be transmitted on demand to a remote medical center or medical consultant around the globe who can provide their consultancy after monitoring the actual data. In this way, doctors or medical consultants who have spare time can be part of this personalized healthcare service model. Using a blockchain application patients pay directly the consultants for exchange of their advice.
Such a model is depicted below based on the idea of business model canvas (Osterwalder et al, 2010). The canvas includes nine blocks which represent four core sections of the business: customers, offer, infrastructure and financial viability. It helps the startup owners to define their strategy and then focus to specific directions for allocating their resources and capabilities matching them to a digital currency – based market.

Table 1. *Business model canvas for personalized healthcare services*

<table>
<tr><th>Key Partners</th><th>Key Activities</th><th>Value Proposition</th><th>Customer Relationships</th><th>Customer Segments</th></tr>
<tr><td rowspan="3">• Healthcare companies
• Blockchain platform
• Investors
• Doctors</td><td>• IoT Platform Development
• Maintenance and update
• Medical consultants availability management</td><td rowspan="3">• Cash free healthcare service
• Secure transaction record
• Chance to earn additional money
• New digital currency application
• New method for medical staff to increase their income</td><td>• Personalised healthcare service
• Co - create value</td><td rowspan="3">• Doctors / Medical consultants
• Patients who need assistance at home</td></tr>
<tr><td>Key Resources</td><td>Channels</td></tr>
<tr><td>• Venture capital
• Software R&D team
• Medical consultants</td><td>• IoT Platform
• Digital marketing</td></tr>
<tr><td colspan="2">Cost Structure</td><td colspan="3">Revenue Streams</td></tr>
<tr><td>• Software development
• IoT Health Care Equipment</td><td>• Salaries
• Marketing</td><td>• Advertising
• Value-added service</td><td>• Acquisition
• Crowdfunding</td><td></td></tr>
</table>

The above business model combines IoT, AI and Blockchain technology in reference to launching Digital Euro to establish a personalized healthcare service offered potentially by a startup. The *key partners* define the network of suppliers and partners: the Digital Euro-based blockchain platform is owned by the startup, but the Doctors are external resources or partners. The *key activities* section describes the main functions to be performed in order for this proposition to work: it includes the development and maintenance of the blockchain – IoT platform as well as the management of the dynamic availability of resources (medical staff).
Key resources define the financial, human, physical and other important assets required by the business model. The above combination will target a specific value proposition: this is the core value of the personalized healthcare service that can be conveyed to the patients (customers). This stands among the peers of patients and medical consultants which is represented in the *Customer relationships* part.
In order to establish the above customer experience, the *Channels* section describes the way that the startup will reach the customers (patients) whereas *customer segments* defines the profiles of customers that the business should consider taking into account common needs, common behaviors or other attributes. The most important costs occurring in the aforementioned business model are depicted in the *cost structure* to be compared against the potential revenue streams. It can be either from one-time transaction or predictable revenue in the future. The difference between cost and revenue determines the profit of the business.

8. Conclusion

In conclusion, the introduction of Digital Euro will affect startups either positively or negatively. The impact of Digital Euro will greatly be determined by the legislation that will be established, especially concerning supporting the startups and facilitating their operations within and outside the European Union. The launch of Digital Euro will be a key in promoting

the rise of tech companies through facilitating investment in the industry and enabling tech startups to benefits from the European market, which is largely dominated by tech companies from the United States and China.

In this paper, we present new business models which can be considered by startups based on IoT, AI and blockchain technologies which will surround the design and functioning of Digital Euro-payments. We elaborate on the concept of the business model canvas of how founders of startups should emphasize to these new technologies to plan for new business ideas. What is missing though is an empirical framework which should depict qualitative and quantitative data from real business environments. These should be collected through further research in order to capture the user experiences within each business, the contribution of the innovative technologies, measure and verify the validity of each value proposition.

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