

Progress on the investigation phase of a digital euro – fourth report

The European Central Bank (ECB) and the euro area national central banks launched the investigation phase of the digital euro project in October 2021. The investigation phase aims to address key issues relating to the design and distribution of a digital euro.

As a collaborative approach is key to the success of a digital euro, the ECB has been engaging extensively with institutional stakeholders, including the European Commission, the European Parliament and euro area finance ministers. Regular dialogue on a digital euro also took place with market stakeholders through the Euro Retail Payments Board (ERPB) to enable banks, payment service providers (PSPs), consumers, merchants and others to provide their views on the design and distribution options identified by the Eurosystem.

This report presents the Eurosystem's views on principles for a compensation model for a digital euro, updates on ongoing work and the results of the prototyping exercise and market research completed in the second quarter of 2023.

While the compensation model for a digital euro will be an important element of the legislative framework for a digital euro, to be decided by co-legislators, the Eurosystem has proposed core principles. The Eurosystem is of the opinion that a digital euro should offer basic services to citizens free of charge, reflecting its status as a public good and in line with users' experience with cash. To foster network effects, the Eurosystem believes that intermediaries should be compensated for the services they provide, as they are for comparable electronic payments, while legislative safeguards should prevent merchants from being overcharged by intermediaries. The Eurosystem would bear its own costs, as it does today for banknotes.

The Eurosystem is currently reviewing all design options endorsed so far to ensure consistency between them and has combined them in a high-level product description that has been presented to stakeholders. As part of this review, the Eurosystem has conducted deep-dive analyses on: (i) porting services, i.e. transferring digital euro holdings from an individual's personal wallet held with one intermediary to another; and (ii) fraud detection and prevention. Work is also ongoing on how to ensure digital financial inclusion. The findings from the review will feed into the conclusions of the investigation phase and inform the Governing Council in its decision – expected in the autumn – on the launch of a possible next phase.

With regard to the prototyping exercise and market research on a digital euro, the prototyping results confirmed that a digital euro could be smoothly integrated into multiple use cases within the existing European payments landscape, while still leaving ample room for innovation. A digital euro could work both online and offline,

using independent designs. The market research aimed to obtain feedback from relevant interested parties and gain non-binding information on potential technical solutions for a digital euro. The research indicated that there is a sufficiently large pool of European providers that are ready to develop digital euro solutions.

In addition, the Rulebook Development Group (RDG), in which representatives from all sides of the market are represented, has continued its work on a draft rulebook for a digital euro scheme. So far, the RDG has focused on use cases and user journeys that are attractive to citizens, merchants and corporates as the users of a digital euro. In parallel, the Group has established several dedicated workstreams: a first workstream explores scheme compatibility in order to leverage existing standards and scheme solutions to the maximum; a second one covers customer identification and authentication, and a third one addresses infrastructure-related requirements.

On 28 June 2023 the European Commission published a draft regulation to establish a framework facilitating the possible introduction of a digital euro. It also published a legislative proposal to strengthen the legal tender status of euro cash. The ECB welcomes both legislative proposals and stands ready to provide technical input to support the work of the European Union (EU) co-legislators. The ECB will also consider any appropriate adjustments to the development of a digital euro that may arise as a result of the legislative deliberations. The ECB's Governing Council will decide in the autumn whether to move to the next phase of the digital euro project. This would allow the Eurosystem to be ready to issue the digital euro, once the legal act has been adopted, and should the Governing Council decide to do so.

This report provides an update on progress made during the digital euro investigation phase over recent months. It follows previous reports published in September 2022¹, December 2022² and April 2023³. This fourth report starts by explaining the Eurosystem’s views on a digital euro compensation model, which has been endorsed by the Governing Council, including considerations on free basic use, network effects, incentives for intermediaries and Eurosystem costs (Section 1, “Principles for a compensation model”).⁴ The report goes on to provide updates on areas of ongoing work, such as the high-level design, considerations on digital financial inclusion, and the envisaged rollout approach (Section 2, “Ongoing work on design and distribution options”).

It then discusses the results of the prototyping exercise and market research that feed into the conclusions of the investigation phase (Section 3, “Prototype and market research outcomes”), as well as the work on the development of a rulebook (Section 4, “Rulebook development”). Finally, the report describes the next steps for the digital euro project (Section 5, “Next steps”).⁵

The ECB has been engaging with many different stakeholders on the design and governance options described in this report.⁶ There has been active engagement with public and private stakeholders and with society at large. Major design issues and policy-relevant aspects are discussed regularly at the European level with the European Parliament and with euro area finance ministers in the Eurogroup. Eurogroup members⁷ and Members of the European Parliament⁸ have expressed support for a digital euro and have emphasised the political nature of the project. There has also been close cooperation with the European Commission with a view to reviewing, at a technical level, a broad range of policy, legal and technical questions.⁹ There is regular dialogue on the topic of a digital euro with market

¹ The first set of design options included issues such as the transfer mechanism, online/offline availability, privacy, and the tools used to control the amount of digital euro in circulation, that have been examined by the ECB and the euro area national central banks as part of the digital euro project launched in October 2021. See ECB, “[Progress on the investigation phase of a digital euro](#)”, 2022.

² The second set of design options included the settlement model, which defines who will settle online or offline transactions, the funding/defunding mechanism, the distribution model, where a digital euro scheme is envisaged, and the role of intermediaries responsible for the onboarding of end users, anti-money laundering checks and consumer-facing services. See ECB, “[Progress on the investigation phase of a digital euro – second report](#)”, 2022.

³ The third set of design options included rules on digital euro access, holdings and onboarding, as well as distribution aspects, such as the scheme access criteria, the delivery approach and the form factor. It also described envisaged digital euro services and functionalities, i.e. core, optional and value-added services, conditional payments and cross-currency functionalities. See ECB, “[Progress on the investigation phase of a digital euro – third report](#)”, 2023.

⁴ For clarity, this report adopts the following terminology for three types of payment: person-to person payment (P2P) users are referred to as individuals, while point-of-sale and e-commerce users are referred to as consumers and/or merchants. The terms “citizens” and/or “residents” are used when differentiating between jurisdictions. When referring to general users in all categories of payments, the term “end user” is adopted.

⁵ For a set of definitions used in the context of the digital euro project, see the [Digital euro glossary](#).

⁶ Further information on stakeholder engagement is available on the [ECB’s website](#) and in the letter from Executive Board member Fabio Panetta to Irene Tinagli, Chair of the Committee on Economic and Monetary Affairs of the European Parliament on the “[Governing Council decision to launch the investigation phase of a digital euro](#)” of 14 July 2021.

⁷ See Eurogroup “[Eurogroup statement on the digital euro project](#)”, press release, 16 January 2023.

⁸ See [European Parliament resolution of 16 February 2023 on the European Central Bank – annual report 2022](#), February 2023.

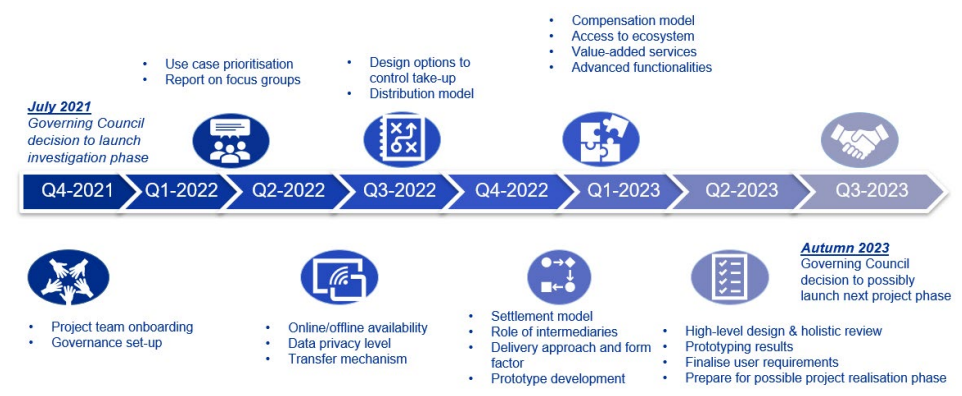
⁹ For more information, see ECB, “[ECB intensifies technical work on digital euro with the European Commission](#)”, press release, 19 January 2021.

stakeholders through the ERPB, so that all sides of the market, including banks, PSPs, consumers and merchants, can offer their views.¹⁰ Market practitioners in the Digital Euro Market Advisory Group have been providing advice on the design and potential roll-out of a digital euro. At the Member State level, euro area national central banks have been engaging with domestic stakeholder groups to ascertain their views on a digital euro.

The ECB welcomes the European Commission’s proposed legislation on digital euro and cash.¹¹ The ECB stands ready to provide technical input to support the work of the European co-legislators, in full respect of the institutional mandate of all actors involved. The ECB will deliver its opinion on the proposed legislation after the summer.¹²

Figure 1: Digital euro project timeline

Tentative – timing subject to change



1

Principles for a digital euro compensation model

A digital euro would be a public good, reflecting the natural evolution of cash in the digital sphere. As such, it should be widely available and possible to use anywhere in the euro area to make and receive payments. But a viable payment ecosystem relies on establishing network effects. For a public good like a digital euro, this implies establishing an appropriate combination of requirements and

¹⁰ For more details of engagement with the ERPB, see the information on stakeholder engagement on the ECB’s website and ERPB Secretariat, “ERPB engagement in the digital euro investigation phase”, 10 November 2021.

¹¹ See “Proposal for a Regulation of the European Parliament and of the Council on the establishment of the digital euro”, European Commission, COM(2023) 369 final, 28 June 2023, and ECB, “ECB welcomes European Commission legislative proposals on digital euro and cash”, press release, 28 June 2023. See also ECB, “Why Europe needs a digital euro”, Contribution by Fabio Panetta, Member of the Executive Board of the ECB, and Valdis Dombrovskis, Executive Vice-President of the European Commission, The ECB Blog, 28 June 2023.

¹²

economic incentives, providing confidence to all parties that the network effects will be achieved.¹³

The compensation model for a digital euro should aim to ensure that all stakeholders can conveniently distribute, accept and pay with digital euro. On the one hand, the compensation model should benefit end users, i.e. primarily private individuals (acting as payers) and merchants (acting as payees). On the other hand, it should incentivise PSPs to distribute digital euro to their customers and to provide acquiring services to merchants.¹⁴ A balance of incentives and costs should contribute to achieving network effects, making a digital euro widely available and usable anywhere in the euro area, and should respect its status as a public good.

While the compensation model for a digital euro will be an important element of the legislative framework for a digital euro, to be decided by co-legislators, the Eurosystem has proposed a set of four core principles.¹⁵ First, as a public good, a digital euro should be free of charge for basic use of private individuals for their day-to-day purposes. Second, legislative safeguards should prevent merchants from being overcharged by intermediaries. Third, intermediaries should still be compensated for the services they provide,¹⁶ just as they are for other digital payments. Finally, the Eurosystem would bear its own costs.

Figure 2: Eurosystem proposal for core principles for a compensation model



1.1 Free basic use by private individuals

The Eurosystem believes that a digital euro should be free for basic use by private individuals. Private customers should not be charged for basic use of digital euro, and distributing PSPs would not be remunerated for providing these fundamental services. This would be consistent with the provision of cash. The Eurosystem believes that the scope of digital euro basic services to be established in

¹³ See Panetta, F., “A digital euro: widely available and easy to use”, Introductory Statement at the Committee on Economic and Monetary Affairs of the European Parliament, Brussels 24 April 2023.

¹⁴ In short, the PSPs that distribute digital euro to payers are referred to as “distributing PSPs” and the PSPs that provide digital euro acquiring services to payees are referred to as “acquiring PSPs”.

¹⁵ The compensation model proposed by the ECB was discussed with market stakeholders (see ECB, “Compensation model”, Item 4, 6th ERPB technical session on the digital euro, 22 February 2023) and received feedback from stakeholders (see ECB, “Written feedback following the 4th ERPB technical session (cross-currency, programmability, scheme access and form factor)”, 24 March 2023).

¹⁶ It should be noted that, so far, only operational costs have been considered for compensation. Initial investment costs will be considered separately.

the legislation should be similar in nature to the basic services that banks are required to provide under the Payment Accounts Directive.¹⁷ These free basic services could therefore include: (i) opening/holding/closing of a digital euro payment account, (ii) non-automated and automated funding and defunding from a non-digital euro payment account, (iii) waterfall/reverse waterfall services,¹⁸ (iv) provision of a basic payment instrument, and (v) initiating and receiving payment transactions.¹⁹

1.2 Network effects generating economic incentives for acquirers and merchants

Legislative safeguards should prevent merchants from being overcharged by intermediaries if they are obliged to accept digital euro as legal tender. On the one hand, PSPs would be able to charge merchants for using digital euro acquiring services.²⁰ On the other hand, legislative safeguards could avoid excessive charges for merchants potentially resulting from the fact that merchants would be legally obliged to accept digital euro as legal tender and hence have little negotiating power vis-à-vis the PSPs that provide digital euro acquiring services.

1.3 Comparable economic incentives for distributing PSPs

PSPs distributing digital euro to private individuals should have a similar level of economic incentive to do so as for other comparable electronic payments. The objective is for PSPs to have comparable incentives to promote the best possible user experience and usability for their customers, as they do for the other electronic payment instruments they distribute. As a way to generate revenue, PSPs could charge customers for the provision of certain services, such as additional payment instruments (for example an extra payment card) and for using additional value-added services building on digital euro functionalities.²¹ However, as PSPs distributing digital euro to customers could be required to offer fundamental services for free (see Section 1.2), their revenue potential would be lower compared with PSPs that charge merchants for digital euro acquiring services. It is therefore proposed that PSPs charging fees to merchants for digital euro acquiring services

¹⁷ Directive 2014/92/EU of the European Parliament and of the Council of 23 July 2014 on the comparability of fees related to payment accounts, payment account switching and access to payment accounts with basic features (OJ L 257, 28.8.2014, p. 214).

¹⁸ See Section 1.3 of ECB, “[Progress on the investigation phase of a digital euro – second report](#)”, 2022

¹⁹ “Basic use” of digital euro could be considered to include the following services: (i) onboarding to digital euro, opening and holding a digital euro wallet, including KYC checks and customer assistance; (ii) funding and defunding the digital euro wallet from the payment account which the person associates it to; (iii) the provision of a basic instrument to pay with digital euro; (iv) making and receiving person-to-person (P2P) payments; (v) making payments to merchants, businesses, or governments (i.e. POI, including POS, e-commerce and P2G); (vi) receiving payments from governments (G2P); and (vii) combinations of the above elements, such as waterfall (i.e. receiving a payment and defunding) and reverse waterfall (i.e. funding and making a payment). The “basic services” can differ from the “core services”. For more information, see ECB, “[Core, optional and value-added services for the digital euro](#)”, 5th ERPB technical session on the digital euro, 6 December 2022.

²⁰ Acquiring services are services provided by payment service providers that allow business users, governments or other public authorities to accept payments at the point-of-sale or in e-commerce.

²¹ For more information, see Section 3.1 entitled “Core, optional and value-added services” in ECB, “[Progress on the investigation phase of a digital euro – third report](#)”, 2023.

should compensate the PSPs offering free services to customers by paying an inter-PSP fee. This arrangement aims to maintain a fair balance of incentives between the two types of PSP.

1.4 Eurosystem bears its own costs

The Eurosystem has proposed that it would bear its own costs, reflecting the status of a digital euro as a public good and following the same logic which currently applies to cash. PSPs would bear their own costs related to the distribution of the digital euro services they provide, but they would not be charged Eurosystem costs related to scheme management and the settlement processing.²² The potential savings that may arise from this should be passed on to end users.

2 Ongoing work on design and distribution options

As part of the digital euro project investigation phase to be concluded by October 2023, the Eurosystem is conducting a holistic review of the high-level digital euro design. To this end, the Eurosystem has reviewed all design options endorsed so far to ensure consistency between them and combined them in a high-level product description.²³ In this context, the Eurosystem conducted a comprehensive review of possible interdependencies between design choices. Following exchanges with stakeholders on the high-level product description in the second quarter of 2023, the findings from the review will feed into the conclusions of the investigation phase and inform the Governing Council in its decision – expected in the autumn – on the launch of a possible next phase.

As part of the high-level design review, the Eurosystem has conducted deep-dive analyses on specific aspects that could have an impact on the design and distribution of a digital euro. In particular, additional work has been conducted on porting services, i.e. transferring digital euro holdings from an individual’s personal wallet held with one intermediary to another one (Section 2.1), and fraud detection and prevention (Section 2.2).²⁴ Further work explored how to ensure digital financial inclusion (Section 2.3) and how to successfully roll out different digital euro use cases (Section 2.4).

²² The Eurosystem would take over costs related to setting and monitoring compliance with the rules and standards of the digital euro scheme. It would also cover the costs of performing the settlement activities (i.e. verifying and recording the transaction) on behalf of the supervised intermediaries that distribute digital euro to end users. For more information on the digital euro scheme, see Section 2 in ECB, “[Progress on the investigation phase of a digital euro – second report](#)”, 2022 and Section 2.1 in ECB, “[Progress on the investigation phase of a digital euro – third report](#)”, 2023. For more information on the settlement model, see Section 2.1 in ECB, “[Progress on the investigation phase of a digital euro – second report](#)”, 2022.

²³ See ECB, “[High Level Product Description](#)”, Item 5, 8th ERPB technical session on the digital euro, 12 May 2023.

²⁴ Fraud is defined in Article 96(6) of the European Banking Authority’s “[Guidelines on reporting requirements for payment fraud data under PSD2](#)”. Fraud prevention and detection was discussed in a meeting of the ERPB. See ECB, “[Fraud prevention and detection](#)”, Item 4, 12th ERPB technical session on the digital euro, 12 May 2023.

2.1 Portability

Additional work includes exploring how to make it as easy as possible for the user to transfer digital euro access from one intermediary to another (so-called porting). This would guarantee freedom of choice for consumers and increase resilience. Users could switch by asking the new intermediary to initiate the porting procedure, similar to how users can take their current mobile number with them when switching to a new provider. Intermediaries would be expected to support the porting of the user's digital euro access as well as their transaction history and recurring payments, at the request of the user. The new intermediary would be able to acquire the necessary data directly from the previous intermediary, without the involvement of the central bank.

By implementing such a procedure, users will have the freedom to seamlessly switch to a different intermediary, even without the support of the previous intermediary. As a result, users will retain uninterrupted access to their digital euro holdings and services, ensuring a smooth transition without any complications. In addition, an emergency portability procedure would allow people to access digital euro holdings even in scenarios in which their own intermediary would not be reachable for a prolonged period of time and the regular portability procedure would not be possible.

2.2 Fraud detection and prevention

Further analysis is ongoing on fraud detection and prevention to ensure a high level of protection for users.²⁵ Effective fraud detection and prevention is essential to maintain trust in a payment method. People will not want to use a digital euro unless they feel it is safe and secure. Protecting users from fraudulent activities will support the digital euro's reputation as an attractive and safe payment method and can also help prevent other illegal activities. Therefore, fraud detection and prevention should be a key feature of a digital euro. To this end, the Eurosystem is exploring how a central support service for fraud detection and prevention could support intermediaries in their fraud management activities, for example through fraud monitoring and risk scoring of transactions, statistics and coordination of information.

2.3 Digital financial inclusion

Promoting digital financial inclusion is a key principle underlying the concept of a digital euro.²⁶ While a digital euro alone may not completely solve the

²⁵ For more information, see ECB, "[Fraud prevention and detection](#)", Item 4, 8th ERPB technical session on the digital euro, 12 May 2023. The stakeholders agreed on the importance of effective fraud detection and prevention (see ECB, "[Written feedback following the 8th ERPB technical session](#)", 16 June 2023).

²⁶ For more information, see ECB, "[Digital financial inclusion](#)", Item 3, 8th ERPB technical session on the digital euro, 12 May 2023). The stakeholders agreed on the importance of effective fraud detection and prevention (see ECB, "[Written feedback after 8th ERPB technical session](#)", 16 June 2023).

challenges of financial and digital exclusion, it should be designed to address barriers that could prevent people at risk of being digitally financially excluded from using digital euro services. This is particularly important given the envisaged legal tender status of digital euro.

A digital euro will be designed to be inclusive and accessible to people with low digital and financial skills and resources, as well as people with disabilities and the elderly. The Eurosystem would seek to design a digital euro app in a way that is mindful of their needs.²⁷ For example, it would be translated into all official EU languages and be compliant with the European Accessibility Act. A digital euro payment card would be available for those who are vulnerable to digital financial exclusion and prefer a physical card to an app while the option for funding and defunding via cash would also allow a simple top-up of digital euro without using a smart phone. Moreover, people should be able to onboard to digital euro either remotely or in-person and would be able to easily switch intermediaries (see Section 2.1). An offline functionality would also support digital euro payments in areas with poor network coverage.

In addition, Union co-legislators and Member States could pursue a harmonised, public approach that ensures that end users at risk of exclusion are onboarded and receive continuous support. The Eurosystem has proposed that at least one dedicated and licensed entity could be identified per country (for example a post office, giro institution or credit union). This entity would be in charge of providing access to digital euro services and the necessary support, to those vulnerable to digital financial exclusion, without any cost to the eligible individuals. For instance, dedicated face-to-face interaction could be offered to help and guide users in need of dedicated support through all the steps of the onboarding process; these users could also receive a physical digital euro payment card, coupled with the possibility of (de)funding the digital euro wallet via cash. Such a dedicated public approach may require legislative action at EU and/or national level and would be for Union co-legislators and Member States to consider; in fact, it is already reflected in the framework for accessing the digital euro proposed by the Commission in the draft legislation.²⁸ The Eurosystem stands ready to provide the necessary technical support and engage with all relevant stakeholders to enable a highly inclusive digital euro.

2.4 Roll-out approach

Successfully rolling out a new means of payment comes with several challenges. This is especially the case for the euro area, given the large number of intermediaries, diverse payment preferences and different payment systems in place

²⁷ A digital euro app, developed by the Eurosystem, would provide a harmonised entry point for users for basic payment functionalities. It would connect to the intermediaries that would perform the services. For more information on all form factors, including a physical card, see Section 2.2 entitled “Delivery approach and form factor” in ECB, “[Progress on the investigation phase of a digital euro – third report](#)”, 2023.

²⁸ See Article 14 of the “[Proposal for a Regulation of the European Parliament and of the Council on the establishment of the digital euro](#)”, European Commission, COM(2023) 369 final, 28 June 2023.

across all the member countries. It requires wide stakeholder engagement, technology development and testing on multiple systems to ensure a robust infrastructure and euro area integration. A roll-out plan is needed to successfully define and coordinate these steps.

The Eurosystem is considering a staggered roll-out of the prioritised use cases in two product releases.²⁹ A gradual roll-out is normal practice in the market when introducing new payment instruments, especially those that are highly complex. In the case of a digital euro, complexity stems from its pan-European reach for specific use cases, for example for point-of-sale payments given its own dedicated physical infrastructure (i.e. point-of-sale terminals) and for government to consumer payments given different infrastructure set-ups by public agencies. Implementing a phased approach to rolling out various use cases of a digital euro across the euro area would mitigate execution risks and minimise delays. By adopting this approach, potential challenges and issues can be addressed and resolved gradually, ensuring a smoother and more efficient deployment process. In addition, this approach would enable users to familiarise themselves gradually with digital euro functionalities, which may support widespread acceptance and enhance user experience across all use cases. The roll-out approach would be further refined and ultimately finalised only in the next phase of the project, should the Governing Council decide to continue with the project.

Figure 3: Proposed staggered roll-out for all euro area markets

| | | |
|----------------|---|---|
| First release |  Person to person | <ul style="list-style-type: none"> • Support network effects • Option for pan-European person-to-person payments • Available online and offline |
| |  E-commerce | <ul style="list-style-type: none"> • Currently no option to pay in central bank money |
| Second release |  Physical stores | <ul style="list-style-type: none"> • Allowing for longer adaption times for infrastructure (or terminals) • Available online and offline |

The first column distinguishes between the two releases. The middle column shows the use case, and the last column highlights motivations behind the decision for gradual roll-out of use cases.

The Eurosystem envisages that a first product release would include person-to-person and e-commerce payments.³⁰ Focus group research showed that person-to-person payments are highly valued by users across the euro area³¹. They are also technically the least complex to implement. Together with e-commerce payments, they could already generate network effects and foster wide acceptance. Furthermore, the

²⁹ To recall, the use cases that the Eurosystem considers for a digital euro are person-to-payments, e-commerce payments, point-of-sale payments and government payments. See also Panetta, F., “[A digital euro that serves the needs of the public: striking the right balance](#)”, introductory statement at the Committee on Economic and Monetary Affairs of the European Parliament, Brussels, 30 March 2022.

³⁰ Consumer-to-government e-payments, as part of government payments, would also be included in this first product release.

³¹ See Kantar Public/ECB, “[Study on Digital Wallet Features](#)”, 2023.

e-commerce use case would make it possible for people to use central bank money over the internet, which is currently not possible with cash.

A second product release would include point-of-sale payments.³² Implementing payments at physical stores may take longer because it would entail the adapting the existing physical infrastructure across Europe. For example, it would most probably require changes to payment terminals and physical devices.³³ A longer adjustment period would allow market participants to adjust in a more efficient, manageable and controlled manner, minimising any adverse consequences that could arise from a sudden or rushed implementation.

The Eurosystem aims to release the online and offline functionalities simultaneously in the first release. Offline transactions would be settled directly between users' devices using "secure hardware".³⁴

3 Prototyping exercise and market research outcome

The Eurosystem conducted a digital euro prototyping exercise and a market research exercise as part of its investigation phase. The findings of these exercises will feed into the conclusions of the investigation phase and have been published,³⁵ in line with the ECB's transparent and open approach to the digital euro project.

3.1 Findings from the prototyping exercise

Between July 2022 and February 2023 the ECB conducted a prototyping exercise on what paying with a digital euro could look like for different use cases. This tested how the design choices for a digital euro could be technically implemented and integrated into the existing European payments landscape. The exercise included the development of a single back-end prototype (i.e. a settlement system designed by the Eurosystem) and five different front-end prototypes (i.e. user interfaces).³⁶ For the back-end prototype, the exercise analysed how privacy could

³² Both consumer-to-government point-of-sale payments and government-to-consumer payments would also be included in this second product release.

³³ Where possible, this would be done via software upgrades rather than replacing hardware.

³⁴ The Eurosystem is committed to delivering an offline functionality for a digital euro that has the following characteristics: (i) transactions are settled using "secure hardware" to avoid hacking and forging, (ii) transactions are settled immediately between devices to align with the legal tender status, (iii) payments received can be transferred to another device without first connecting to the internet, and (iv) the Eurosystem will not see users' personal details or their payment patterns.

³⁵ For more information, see ECB, "[Digital euro – Prototype summary and lessons learned](#)", 26 May 2023 and ECB, "[Market research outcome report](#)", 26 May 2023. See also the letter from Executive Board member Fabio Panetta to Irene Tinagli, Chair of the Committee on Economic and Monetary Affairs of the European Parliament on the "[Results of the digital euro prototyping exercise and market research](#)" of 26 May 2023 and ECB, "[Market research and prototyping exercise confirm feasibility of technical solutions and user interfaces for a digital euro](#)", *MIP News*, 26 May 2023.

³⁶ Each proposed user interface was tailored to one of the five prioritised use cases for a digital euro, namely: (i) person-to-person payments conducted online, (ii) person-to-person payments conducted offline; (iii) payments initiated in shops by the payer, (iv) payments initiated in shops by the payee; and (v) e-commerce payments. For background information, see ECB, "[ECB selects external companies for joint prototyping of user interfaces for a digital euro](#)", *MIP News*, 16 September 2022.

be protected and how integration in the existing payment landscape could be facilitated. During the exercise, no personal data was processed for participants in either the Eurosystem or the front-end prototype.

The results of the prototyping exercise show that a digital euro could be smoothly integrated into the existing European payment landscape to serve different use cases, while still leaving ample scope for innovative features and technologies. The back-end prototype developed by the Eurosystem proved capable of supporting different types of transaction, while protecting users' privacy by not revealing their payment patterns or account balances to the Eurosystem.³⁷ In parallel, market participants successfully implemented and tested five payment scenarios for person-to person payments, payments in shops and online. The findings also show that, using independent designs, a digital euro could theoretically work both online and offline, thereby also increasing the resilience of the digital euro ecosystem.

The prototyping exercise in no way pre-judges the possible development of a digital euro. The prototypes were developed as research tools as part of a learning experiment and will not be used for developing future payment solutions. Furthermore, the prototype API specifications³⁸ do not pre-judge possible alternative designs, and the specific choices made for the prototypes will not affect any decision relating to a specific technology or functionality for the final digital euro design.

3.2 Market research outcomes

The digital euro market research, launched on 13 January 2023, aimed to obtain feedback from relevant interested parties and gain non-binding information on potential technical solutions for a digital euro.³⁹ It covered twelve different technical components that may be needed to support a digital euro, addressing ways to deal with their development, maintenance and operation. These components would enable the issuance and redemption of digital euro, the initiation, processing and settlement of transactions, the management and protection of user access and user data, and all necessary interfaces between digital euro components

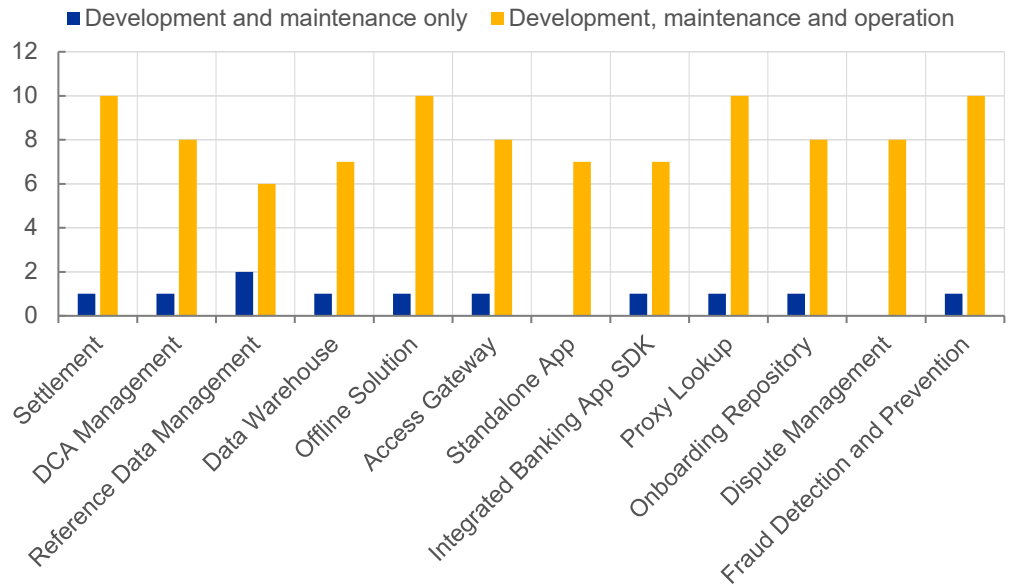
³⁷ For the back-end prototype, the Eurosystem developed a centralised settlement engine (N€XT), based on an unspent transaction output (UTXO) data model commonly used for transactions with digital currencies. For more information, see ECB, "[Digital euro – Prototype summary and lessons learned](#)", 26 May 2023.

³⁸ The full prototype application programming interface (API) specifications were published on the same day as the results of the prototyping exercise.

³⁹ See ECB, "[Market research on possible technical solutions for a digital euro](#)", *MIP News*, 13 January 2023 and ECB, "[Market research outcome report](#)", 26 May 2023. See also the letter from Executive Board member Fabio Panetta to Irene Tinagli, Chair of the Committee on Economic and Monetary Affairs of the European Parliament, "[Results of the digital euro prototyping exercise and market research](#)" of 26 May 2023.

and with digital euro users. Each component could be developed and operated either by market actors or in-house by one or more Eurosystem central banks.

Figure 4: Overview of number of responses received per component



DCA refers to Dedicated Cash Account and SDK refers to Software Development Kit.

The research indicates that there is a sufficiently large pool of European providers that are ready to develop digital euro solutions. Overall, 29 responses were received. They suggest that different types of architectural and technological design options are available to build a technical solution for a digital euro. The feedback received has helped the Eurosystem better understand the current level of knowledge and experience in the market but does not imply that any of the solutions presented by the respondents are necessarily optimal or best-fit solutions for a digital euro. Participation in this market research exercise was entirely voluntary and this cohort of participants will therefore still be eligible for future procurement procedures related to a digital euro or any other procurement. However, their involvement in this exercise does not imply a pre-selection for, nor put them at an advantage in, any potential subsequent tenders.

4 Rulebook development

The Rulebook Development Group (RDG) has continued its work on a draft rulebook for a digital euro scheme.⁴⁰ Work on a first draft is based on six key

⁴⁰ For more information, see ECB, “[Update on Rulebook development](#)”, Item 6, 6th ERPB technical session on the digital euro, 22 February 2023. See also ECB, “[Mandate of the digital euro scheme Rulebook Development Group](#)”, 2023 and ECB, “[Digital euro scheme Rulebook Development Group status update](#)”, 7 June 2023.

building blocks.⁴¹ So far, the RDG has focused on use cases and user journeys that are attractive to citizens, merchants and corporates as the users of a digital euro. Feedback from representatives of these user groups on the demand side in the RDG indicates that they indeed find the user journeys as agreed in the RDG attractive for consumers and merchants.⁴² Work on the adherence model (concerning, for example, scheme eligibility criteria and obligations of participants) will start in due course, following the publication of the legislative proposal by the European Commission. In parallel, the Group has established three dedicated workstreams so far. The first workstream covers scheme compatibility and aims at leveraging existing standards and scheme solutions to the maximum. The second workstream covers customer identification and authentication requirements for a digital euro, while the third will work on infrastructure-related requirements, with the aim of proposing technical and non-functional requirements covering relationships between intermediaries and end users.⁴³

5 Next steps

All European institutions must play their part to achieve the common goal of making the digital euro a success, bearing in mind their respective roles and mandates.

The ECB welcomes the legislative proposals on digital euro and legal tender status of euro cash presented by the European Commission on 28 June.⁴⁴ The proposed legal tender status for a digital euro would ensure it is widely accepted as a means of payment. The provision whereby people can get digital euro through their bank on request would make it easily accessible and ensures that nobody would be left behind. The ECB stands ready to provide technical input to support the work of the EU co-legislators. The European Commission has recommended that the European Parliament and the EU Council consult the ECB on the proposed legislative changes. Following requests for consultation, the ECB would deliver its opinion in due course. In parallel, the Eurosystem will continue to engage actively with all stakeholders throughout the remainder of the investigation phase.⁴⁵

The Governing Council will review the outcome of the investigation phase in autumn 2023 and will decide whether to instigate a subsequent project phase in which the appropriate technical solutions and business arrangements could

⁴¹ The building blocks are: (i) a functional and operational model (end-to-end flows, core requirements for supervised intermediaries, minimum user experience standards, etc.); (ii) an adherence model (scheme eligibility criteria, obligations of participants, etc.); (iii) technical scheme requirements (IT infrastructure, application programming interface implementation, technical standards, etc.); (iv) risk management; (v) scheme management (scheme governance, change management processes, etc.); and (vi) scheme generics (defined terms, change history, scope of the digital euro scheme, etc.).

⁴² See ECB, “[Digital euro scheme Rulebook Development Group status update](#)”, 7 June 2023.

⁴³ See ECB, “[Call for expressions of interest to participate in scheme compatibility digital euro workstream](#)”, *MIP News*, 3 March 2023; see ECB, “[Call for candidates to participate in the digital euro identification and authentication workstream](#)”, *MIP News*, 8 May 2023; see ECB, “[Call for candidates to participate in the digital euro scheme infrastructure-related requirements workstream](#)”, *MIP News*, 8 May 2023.

⁴⁴ See “[Proposal for a Regulation of the European Parliament and of the Council on the establishment of the digital euro](#)”, European Commission, COM(2023) 369 final, 28 June 2023, and ECB, “[ECB welcomes European Commission legislative proposals on digital euro and cash](#)”, press release, 28 June 2023.

⁴⁵ For information on stakeholder engagement, see the [ECB's website](#).

be developed and tested. The ECB will consider any appropriate adjustments in the development of a digital euro that may arise as a result of the legislative deliberations. A possible decision by the Governing Council to issue a digital euro would be taken only after the legislative act is adopted.