

# NORGES BANK PAPERS

Status report –  
Norges Bank's central bank  
digital currency project

NO. 2 | 2020



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CENTRAL BANK  
DIGITAL CURRENCY  
PROJECT

# 1. Introduction

A central bank digital currency (CBDC) is a digital form of central bank money denominated in the official unit of account for general purpose users. It is a claim on the central bank, in the same way that banknotes and coins are today. By comparison, bank deposits are claims on private banks.

Owing to declining cash usage and the possibility of major structural changes in the monetary and payment system, Norges Bank is assessing whether it is appropriate also to issue a digital form of central bank money to ensure that members of the public are able to pay efficiently and securely in Norwegian kroner also in the future.

In Norges Bank (2018), a Norges Bank working group presented an overview of factors that should be given weight in an assessment of whether Norges Bank should issue a CBDC in addition to cash. In Norges Bank (2019), the working group took a closer look at possible objectives of a CBDC and alternative designs for achieving these objectives.

The CBDC project is now in its third phase.<sup>1</sup> The purpose of publishing this status report is to provide information about the work, disseminate knowledge and invite stakeholders to a dialogue.

## 2. Purpose and deliveries in the project's third phase

The purpose of the project's third phase is to provide a more solid foundation for assessing whether Norges Bank should work to issue a CBDC and if so, in what form. Project deliveries are to include:

- a) Examining relevant detailed CBDC solutions on the basis of the proposed solutions in (2019) with assessments of, among other things, necessary and desirable characteristics.
- b) Performing further analyses of the motivation for and impact of a CBDC where the working group deems it necessary in order to make a recommendation.
- c) Summarising and systematising international developments and any new factors in the international debate on CBDCs and related issues.
- d) During 2021 Q1, issuing a recommendation to central bank executive management as to whether Norges Bank is to work further on a specific CBDC solution and what a fourth phase, if any; should contain.

This status report will primarily consist of a briefing on work on point a).

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<sup>1</sup> The project working group comprises Knut Sandal (chair), Ragna Alstadheim, Tom Bernhardsen, Kjetil Heltne, Arne Kloster, Helge Syrstad, Ylva Søvik, Leif Veggum, Peder Østbye, Terje Åmås and Steinar Årdal. Carola Müller contributes to a sub-project. The steering group comprises Torbjørn Hægeland (chair), Ingrid Solberg (took over from Ida Wolden Bache on 1 April 2020), Olav Bø, Kasper Roszbach and Marius Ryel. The working group can be contacted at [knut.sandal@norges-bank.no](mailto:knut.sandal@norges-bank.no) and [peder.ostbye@norges-bank.no](mailto:peder.ostbye@norges-bank.no).

### 3. International trends

Central banks worldwide are working increasingly on CBDCs. Boar et al (2020) documents a survey on work on CBDCs in 2019 in which 66 central banks responded:

- A good 80 percent of the central banks were working on a CBDC, compared with a good 70 percent in 2018.
- Most were working on a variant of a CBDC for general purpose users. Many also looked at a CBDC for settlement between financial institutions.
- Only 10 percent of the central banks had technical solutions under development or in pilot testing. Most were working on analyses and proofs of concept that (for the time being) did not involve development and testing.

The Riksbank is currently pilot testing a technical solution for an e-krona (see Riksbank (2020)). Other countries that have tested or are about to test technical solutions for a CBDC for general purpose users include China, Uruguay, Ecuador, the Bahamas and Ukraine.

### 4. Validation of solutions

The characteristics of a CBDC were outlined in Norges Bank (2019):

Necessary characteristics	Desirable characteristics
Claim on Norges Bank	Can provide the desired degree of data protection (beyond requirements under EEA law)
Value parity with bank money/cash	Offline payment functionality
Customer orientation	Platform for third-party providers
Adequate frictions vis-à-vis bank money	Monetary policy instrument
Controlled by Norges Bank	Provide information relevant to Norges Bank's macroeconomic monitoring
Capable of functioning as legal tender	DLT compatibility
Compliant with obligations under EEA law	Attractive niche solution
Settlement of payments immediately and with finality	
Compliant with sound IT architecture principles	
Satisfy requirements related to technical autonomy	
Customer communication and due diligence undertaken by third parties	

## Technical solutions recommended in Norges Bank (2019):

Solution	Explanation
A CBDC in the form of register-based token money	The CBDC is linked to a register and is accessed via cryptographic codes not associated with an identity. In practice, the user interface (such as a mobile wallet app) could provide a simple and secure means of accessing the funds. These solutions share some technological features with current cryptocurrencies.
Closed account solution offering the option of local storage	Account solution requiring both payer and payee accounts. This has similarities with current e-money solutions. This solution is combined with a functionality to “load” funds onto a physical device (eg a card or mobile phone) for offline use.

The working group has organised a subgroup tasked in particular with validating technical solutions, including:

- Elaborate on and clarify/specify necessary and desirable characteristics.
- Investigate technical solutions in more detail.
- Perform validation.
- Recommendation and set-up for pilot testing, “sandbox”, test network or other form of testing.

The work can be compared to what is often referred to as proof of concept, where the feasibility of various concepts is studied against specifications/characteristics.

The implementation of a computer system passes through different phases:<sup>2</sup>

Specification → Design → Technical implementation → Testing

Norges Bank has to date not tested technical solutions but has focused on specification and design. This work has iterated between necessary and desirable characteristics listed in Norges Bank (2019) and technical solutions recommended in Norges Bank (2019). This means going back and forth between characteristics and technical solutions as knowledge is gained.<sup>3</sup> The purpose is to assess whether technical solutions have the necessary and desired characteristics and, if applicable, whether the characteristics need to be specified further.

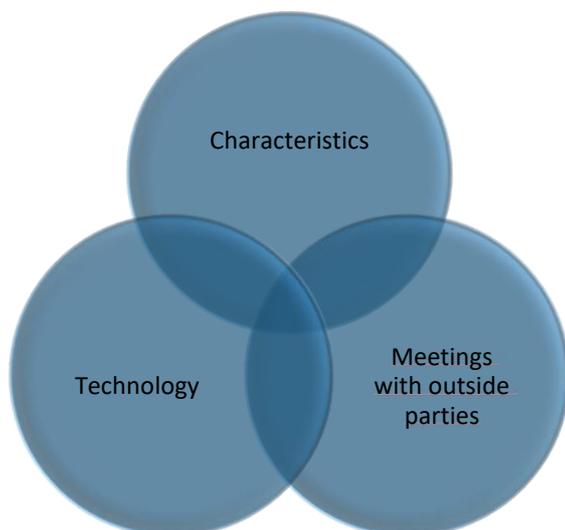
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<sup>2</sup> See Turner (2018).

<sup>3</sup> In line with the “agile development” principle.

Validation work is performed in three partly overlapping work streams:

- Specification of characteristics
- Meetings with outside parties
- Analysis of relevant technological solutions



## 4.1. Specification of characteristics

Experience shows that there is a need to specify characteristics in more detail than in Norges Bank (2019) in order to assess whether different technical solutions can fulfil the characteristics. For example, an assessment of whether Norges Bank has control over a system containing elements of distributed ledger technology (DLT) requires a specification of what is adequate control. Further specification is also necessary for weighing characteristics against one another, where fulfilment of one characteristic can conflict with fulfilment of another.

## 4.2. Meetings with outside parties

The working group has organised or planned information meetings with

- technology providers,
- user representatives and
- government authorities.

Some meetings came about after outside parties contacted Norges Bank, while others were on the initiative of Norges Bank. We are planning several such information meetings this autumn and are open to queries from parties who wish to speak with us.

Technology providers we have met with include providers of CBDC-relevant technology and consultancies. They have provided information and shared their views on how necessary and desirable characteristics can best be realised. Several of the technology providers offer solutions based on DLT, including blockchain technology. We would like to make it clear that Norges

Bank has not taken a position on a preferred technology for a CBDC system if implemented.

User representatives are typically organisations representing users and representatives of parties that would be affected by a CBDC. Government authorities can be relevant both as users and as regulators.

The working group has been in contact with the Riksbank and the Central Bank of Iceland to discuss technical solutions, among other topics.

The working group has also reported on – and received comments on and suggestions for - its work on a CBDC at a number of conferences and seminars.

The working group is planning an external seminar in autumn 2020 about user needs and technical solutions.

### 4.3. Technology

The purpose has been to gain more insight into relevant technical solutions for CBDC systems and how they can be tested. The working group has reviewed different elements of the relevant technologies and solutions chosen for pilot testing in other countries.

### 4.4. Some preliminary assessments

The work on validation has taken place in parallel with pilot testing carried out by a number of central banks,<sup>4</sup> and several publications by central banks and other parties have come out that go into more detail on design and technical solutions.<sup>5</sup>

A common feature of the international work seems to be that CBDCs in the form of register-based token money (including the use of variants of DLT technology) appear to be a more viable alternative than previously. For example, the Riksbank has chosen a technical design based on DLT to pilot test (see Riksbank (2020)). Our assessment in phases 1 and 2 was that DLT was not mature enough and that considerable development was necessary for it to be relevant for a CBDC. We assume that a number of central banks would have focused more on account solutions if time had been a constraint.

Even though most of the focus in validation work has so far been on DLT, the design and characteristics of some existing account systems have been assessed, such as the Octopus system in Hong Kong.

The impression is that DLT requires more detailed specification of characteristics than account-based solutions, in part because there may be cases of doubt as to whether the characteristics have been fulfilled. Furthermore, there are not as many market-tested DLT solutions to choose from as there are account-based solutions.

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<sup>4</sup> See, eg, Riksbank (2020), National Bank of Ukraine (2019) and Central Bank of the Bahamas (2019).

<sup>5</sup> See, eg, Bank of England (2020), Auer and Boehme (2020), WEF (2020), Consensus (2020) and Allen et.al (2020).

Validation work has focused on how different variants and elements of DLT – but also where the actual CBDC register is not necessarily based on DLT – can contribute to the adequate fulfilment of necessary and desirable characteristics.<sup>6</sup>

The final report from phase 3 will contain a recommendation for a framework for pilot testing if a decision is made to move forward. This has so far not been considered in detail. However, a preliminary assessment is that it would make little sense to duplicate pilot tests conducted in other countries. Knowledge from other pilot projects can be acquired through the exchange of experience. It must also be considered whether physical testing can be conducted as a form of “sandbox” or a test network where several operators can test solutions, instead of a traditional pilot test where a single operator is chosen in a tender competition.

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<sup>6</sup> An important question is whether a CBDC register can benefit from external DLT overlay solutions. This entails designing the CBDC to be cryptographically compatible with DLT solutions offered by other operators, so that the CBDC can be locked into such a system for using services there, without a credit risk for users. In such cases, fulfilment of the potential characteristics will be left to the market (eg offline solutions and increased anonymity for payment transactions) and that the CBDC can be a platform for innovation. This also means that Norges Bank can provide a relatively simple core solution, while more advanced functionalities (such as smart contracts) are left to the market. This is a type of organisation that the Bank of England seems to be leaning towards (see Bank of England (2020)). However, such overlay solutions may entail an operational risk for users, which also may give rise to a reputational risk for Norges Bank. This is therefore something we will study further.

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