APPENDIX 1

QUESTIONS LINKED TO THE REQUEST FOR INFORMATION (RFI) FOR FEASIBILITY STUDY IN THE E-KRONA PROJECT

Dnr 2022-00329

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1 Definitions and concepts

The following meanings apply in this RFI:

Definition/Concept	Meaning
API	Application Programming Interface.
CBDC	See Central Bank Digital Currency.
Central Bank Digital Currency (CBDC)	Digital money issued by a central bank and listed as a liability item on the central bank's balance sheet.
DLT	Distributed Ledger Technology.
ECB	European Central Bank.
End-user	Authority, natural or legal person with access to e-krona.
E-krona	A Central Bank Digital Currency available to the public issued by the Riksbank in Swedish krona (SEK).
E-krona platform	A technical infrastructure (software and hardware) on which applications and services are built for the implementation of an e-krona system.
E-krona system	The e-krona platform including applications and services.
Intermediary	Collective name for different forms of actors connected to the e-krona platform. Legal person with the right to act as agent and/or provide e-krona services.
Payment	Payment transaction.
Payment service	Such services described in Chapter 1, Section 2 of the Payment Services Act (2010:751).
Payment service provider	As the term is defined in the Payment Services Act (2010:751).
Payment transaction	As the term is defined in the Payment Services Act (2010:751).
P2B	Transaction from a natural person (private person) to a legal person (business or authority), “person-to-business”.
P2P	Transaction between two natural persons (private individuals), “person-to-person”.
RIX	The Riksbank's settlement system for large-value payments.
Settlement	Final regulation of commitments in a Settlement system.
Settlement system	A settlement system that has been notified by a state within the European Economic Area to the European Securities and Markets Authority (ESMA) or to the EFTA Surveillance Authority, or equivalent settlement system.
TIPS	Target Instant Payment Settlement
Token	Uniquely identifiable digital units of value
Two-tier model	A distribution model in which the Riksbank issues e-kronas and private agents provide these for End-users.
UTXO	Unspent transaction output

2 Preconditions

For this request for Information (RFI), the Riksbank has defined certain preconditions that must be fulfilled in order for a solution to be considered by the Riksbank.

- The Riksbank's part of the e-krona platform shall be implemented in the Riksbank's data centres and may not be based on public cloud services
- The e-krona shall be regarded as money issued and guaranteed by the Riksbank

The figure below is an overall description of a possible e-krona ecosystem, and this provides a framework for the RFI. However, it does not necessarily mean that this is the ecosystem that would be applicable in the event of an e-krona being launched.

There are different levels of Intermediaries with e-krona distribution rights and of payment institutions without distribution rights. They have different functions, rights and obligations, just as in the current financial system. The role of the Riksbank is central and the Riksbank will at least, depending on the technical solution, operate its own part of the e-krona platform.

In addition to the Intermediaries described above, there are various technical actors (acquirers, card issuers, cash terminal operators, etc.) as well as End-users such as consumers, businesses and authorities in the ecosystem.

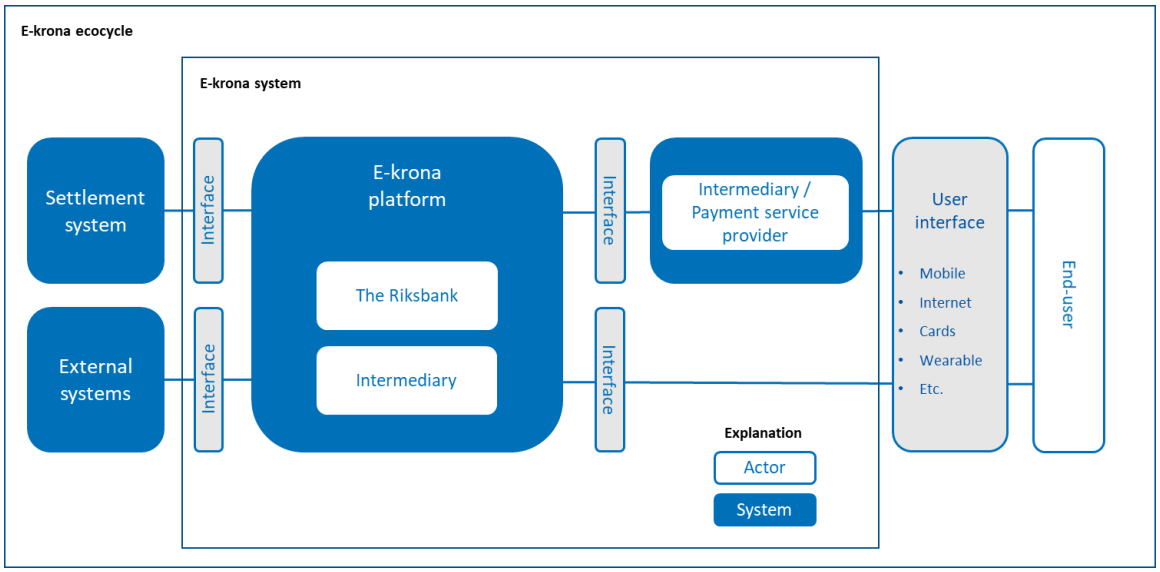

Figure 1 – Example of an overall model

No.	Question
1.	Please indicate if there are any of the preconditions that you are currently unable to fulfil and how you consider this can be resolved.
Response:	

3 Categories of technical solutions

The Riksbank has defined five main technologies for CBDC solutions as interesting for this RFI and to learn more about. The overall model to be used as a basis is described above, and the Riksbank is interested in understanding how the technology categories below can fit into the proposed model. These are:

1. **Digital banknote:** A solution with e-kronas represented by unique digital units of value with fixed denominations.
2. **DLT/blockchain, account-like:** A solution with e-kronas represented by digital units of value that can have different values. The balance of the accounts is available in the DLT/block chain.
3. **DLT/blockchain, UTXO-based**: A solution with e-kronas represented by digital units of value that can have different values. The balance is **not** available in the DLT/block chain, i.e. it needs to be calculated.
4. **Traditional account system** (**core banking)** – A solution based on existing banking systems, i.e. a traditional account-based solution.
5. **Hardware bearer instrument (HBI) solutions** that do not fall into any of the above categories.

No.	**Question**
2.	Please indicate which of the above five key technologies your solution belongs to. If you don't find a category that it fits in, please describe the technology on which it is based.
Response:	
3.	Please indicate whether your solution as a whole, or what parts, are currently in production, for what purpose and in what way it is used and how large volumes it handles.
Response:	

4 E-krona ecocycle

The Riksbank sees the following overall ecocycle for an e-krona and a potential supplier should understand all the steps, which the Riksbank would also like you to describe in detail in the use cases specified later in the RFI.

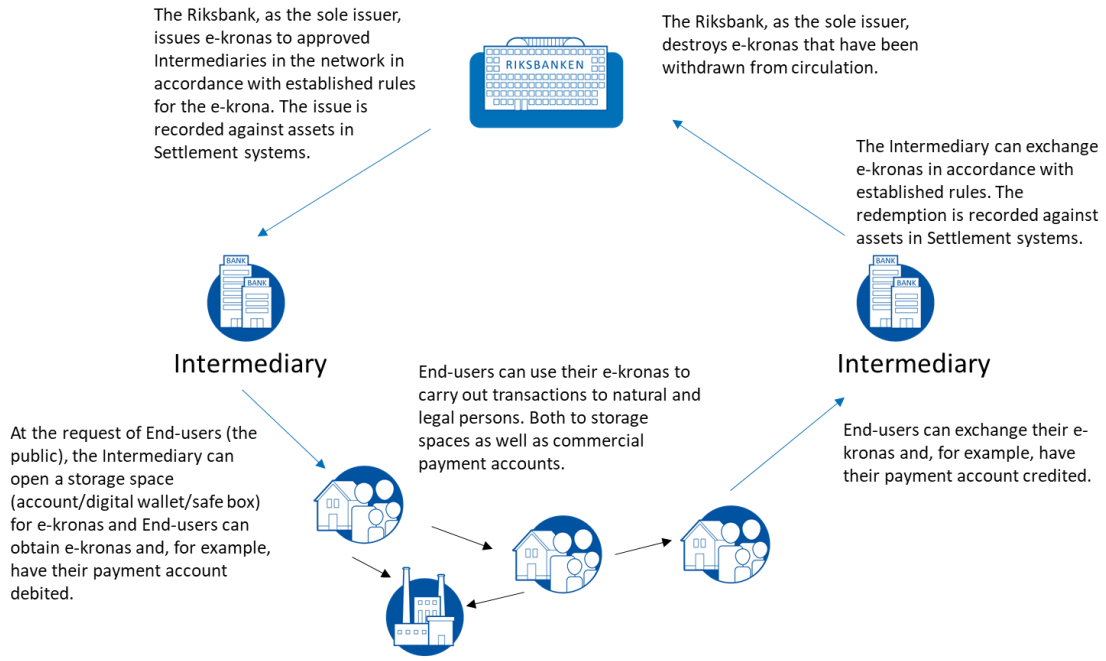

Figure 2 - Overall description of the e-krona ecocycle

No.	Question
4.	Give an overall description of your solution based on the above figure so that the Riksbank has a general picture of what your solution covers based on the needs of a central bank to implement a complete solution involving everything from the e-krona platform, including its components, to different types of roles as Intermediaries, end users and others.
Response:	
5.	Describe how your solution supports the two-tier model outlined by the Riksbank in Figure 1.
Response:	

5 Use case

Enter your answers in the table below in the expanding response boxes. If you have diagrams, etc. that are better suited to be submitted in a separate document, you can refer to it in the response box. If you refer to separate documents, the Riksbank would like you to indicate your answers in these documents under a separate heading for each use case.

5.1 Use case 1 - Issuance

	Description
Objective:	The issuance of e-kronas with the following fulfilled criteria: • Only the Riksbank shall be able to issue e-kronas and only provide them to approved e-krona Intermediaries. • The Riksbank shall be able to issue e-kronas to Intermediaries against their reserves in the Riksbank's Settlement systems, such as RIX and TIPS. • The solution shall allow the Intermediary to clearly separate Riksbank-issued e-kronas from other forms of assets and money for anyone who has e-kronas or receives e-kronas.
Flow of events:	• Describe each individual activity/event in a sequential flow chart, as well as in descriptive text, showing the role that initiates each activity/event. • Please number each activity/event so that it can be referenced in the explanatory text and in future communication.
Response:	

5.2 Use case 2 - Withdrawal

	Description
Objective:	Withdrawals of e-kronas with the following fulfilled criteria: • End-users shall be able to open a storage space that contains e-kronas. • End-users shall be able to keep e-kronas separate from other types of assets and money, both their own and those of Intermediaries. • End-users shall be able to exchange e-kronas for commercial bank money.
Flow of events:	• Describe each individual activity/event in a sequential flow chart, as well as in descriptive text, showing the role that initiates each activity/event.

	Description
	• Please number each activity/event so that it can be referenced in the explanatory text and in future communication.
Response:	

5.3 Use case 3 – Person-to-Person transaction (P2P)

	Description
Objective:	Transaction with e-kronas with the following criterion fulfilled: • Ability for End-users to carry out transactions with e-kronas connected to different types of payment instruments to other End-users belonging to natural persons.
Flow of events:	• Describe each individual activity/event in a sequential flow chart, as well as in descriptive text, showing the role that initiates each activity/event. • Please number each activity/event so that it can be referenced in the explanatory text and in future communication.
Response:	

5.4 Use case 4 – Person-to-Business transaction (P2B)

	Description
Objective:	Transaction with e-kronas with the following criterion fulfilled: • Ability for End-users to carry out transactions with e-kronas linked to various types of payment instruments to commercial payment- and bank accounts belonging to legal persons.
Flow of events:	• Describe each individual activity/event in a sequential flow chart, as well as in descriptive text, showing the role that initiates each activity/event. • Please number each activity/event so that it can be referenced in the explanatory text and in future communication.
Response:	

5.5 Use case 5 - Deposit

	Description
Objective:	Deposit of e-kronas with the following criteria fulfilled: • Natural and legal persons who are owners of e-kronas shall be able to exchange these for commercial bank money at Intermediaries. • Intermediaries shall be able to receive and store e-kronas, separated from other assets, at the request of natural and legal persons who wish to exchange e-kronas for commercial bank money.
Flow of events:	• Describe each individual activity/event in a sequential flow chart, as well as in descriptive text, showing the role that initiates each activity/event. • Please number each activity/event so that it can be referenced in the explanatory text and in future communication.
Response:	

5.6 Use case 6 – Redemption

	Description
Objective:	Redemption of e-kronas with the following criteria fulfilled: • Approved Intermediaries shall be able to redeem e-kronas at the Riksbank. • Redemption of e-kronor shall take place against assets in Settlement systems, such as RIX or TIPS. • The Riksbank, and only the Riksbank, shall be able to destroy e-kronas.
Flow of events:	• Describe each individual activity/event in a sequential flow chart, as well as in descriptive text, showing the role that initiates each activity/event. • Please number each activity/event so that it can be referenced in the explanatory text and in future communication.
Response:	

6 Specific questions and descriptions

The Riksbank has identified a number of areas where it is important to understand how the supplier solves technical challenges identified by the Riksbank in its work with other central banks, pilot projects and in contacts with various market stakeholders. Suppliers are asked to answer as clearly and as detailed as possible so that the Riksbank can make an assessment of the solution and select which suppliers it wishes to meet for an in-depth discussion as well as any demonstrations and tests.

The questions are divided into one of the following areas:

1. General questions
2. Architecture
3. Process management
4. Sustainability
5. Integrity
6. Availability
7. Scalability
8. Security

6.1 General questions

No.	Question
6.	How does the solution guarantee that e-kronas, throughout the life cycle, are issued by the Riksbank?
Response:	
7.	Describe the concept of how and when the money in the solution is transferred from the payer to the payee in connection with a Payment. • What features and components of your solution are involved? • Are functions and components of other actors outside your solution involved? If so, describe which ones.
Response:	
8.	Describe your solution's protection against double spending and counterfeiting.
Response:	
9.	Describe in concrete terms how money is represented in your solution, e.g. through digital units of value, any attributes and properties (such as fixed or optional denominations and serial numbers), recorded values such as balance and transactions linked to the balance of an account-based system, transactions in a block chain, etc.
Response:	
10.	Describe any support for cross-border payments including standards you currently follow or future adaptation options for this.
Response:	

No.	Question
11.	Describe what interoperability, in relation to other CBDC systems, traditional banking systems, possible global providers like Swift and standards, is currently supported by the solution. If parts of this do not exist, how do you plan to achieve this?
Response:	
12.	What payment instruments do you support in your solution and in what way?
Response:	
13.	Describe the support for external party integration through APIs that your solution offers. Please describe all levels of integrations (Central Bank, Intermediaries, Payment Service Provider, etc.) for which APIs are available.
Response:	
14.	Please describe the transaction monitoring support your solution offers.
Response:	
15.	Describe the address concept you use in the solution and describe how users can easily address payments.
Response:	
16.	Describe the support for identifying natural and legal persons your solution offers.
Response:	
17.	Describe if and if so how you handle off-line payments. Describe parts such as identification, protection against double spending, time limits for off-line, etc., so that the Riksbank understands both the security and functionality of your solution.
Response:	

6.2 Architecture

No.	Question
18.	Describe the application architecture of the solution.
Response:	
19.	Describe the conceptual data model.
Response:	
20.	Describe the data logging and traceability your solution offers to track transactions during the e-krona ecocycle, see Figure 2.
Response:	

No.	Question
21.	List all software included in your solution (including open source) with information about the required license types and which have a license cost.
Response:	

6.3 Process management

No.	Question
22.	Describe the operational processes required to maintain the operation of the solution for the Riksbank and any other actor.
Response:	
23.	Describe the roles and any tools that the solution requires.
Response:	
24.	Describe how fault management is done in the solution and the process of rectifying faults detected during operation for the various Intermediaries.
Response:	
25.	Describe your application and system update process.
Response:	
26.	Describe how availability is affected when upgrading applications and systems.
Response:	

6.4 Sustainability

No.	Question
27.	Have you made a calculation of the climate footprint your solution give rise to? If so, describe how you have calculated it.
Response:	
28.	Are you working actively to reduce the overall climate footprint of your solutions? If so, describe how.
Response:	

6.5 Integrity

No.	Question
29.	How does your solution protect personal data?
Response:	
30.	How does your solution deal with financial confidentiality, what information is shared among Intermediaries?
Response:	
31.	What country's legislation did you base your solution design on?
Response:	
32.	Does your solution support anonymous payments? If so, describe how the solution works.
Response:	

6.6 Availability

No.	Question
33.	Describe how your solution ensures high availability.
Response:	
34.	Describe support for load balancing and/or hot/cold standby in your solution.
Response:	
35.	Describe your solution's support for disaster recovery by describing how information is recovered if it is intentionally or unintentionally corrupted or deleted.
Response:	
36.	Describe how your solution can handle different types of crisis situations. For example, are there established backup procedures such as the possibility to activate alternative routes for traffic, alternative operating sites, process and reasoning for moving the system to other operating sites?
Response:	

6.7 Scalability and performance

No.	Question
37.	Describe end-to-end performance of the solution, measured from End-user to End-user in a P2P payment case (a transaction with finality). Include information on response times for the solution during load and number of transactions per second. Please indicate your answer by describing the performance tests you have performed. The Riksbank is primarily interested in tests carried out in production-like environments, such as acceptance test environments, with as production-like loads as possible. The Riksbank would also like you to describe the conditions under which the tests were carried out.
Response:	
38.	Explain what you could demonstrate to the Riksbank if you proceed in the RFI process.
Response:	
39.	Describe possibilities to scale up systems (horizontal and vertical scale-up), including how long it takes to scale up the solution, and the procedure.
Response:	
40.	Describe whether the performance of the solution can be monitored and how.
Response:	

6.8 Security

No.	Question
41.	Has the solution been developed according to an information security management system such as ISO, ISF, NIST or equivalent?
Response:	
42.	What security measures are included in the solution and are there any reasons for the measures?
Response:	
43.	What encryption algorithms are used and for what in the solution?
Response:	
44.	What hash functions are used and for what in the solution?
Response:	
45.	Describe the process of changing encryption algorithms and/or hash functions in the solution. Also describe how different actors are affected, such as End-users and the central bank.
Response:	

No.	Question
46.	What keys or passwords are used for what in the solution?
Response:	
47.	Describe the process of changing keys and/or passwords in the solution, and how it affects the Intermediaries.
Response:	

SVERIGES RIKSBANK
Tel +46 8 - 787 00 00
registratorn@riksbank.se
www.riksbank.se