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“Towards the Tokenization of Business Process Models using the Blockchain Technology and Smart Contracts”

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SEMiT

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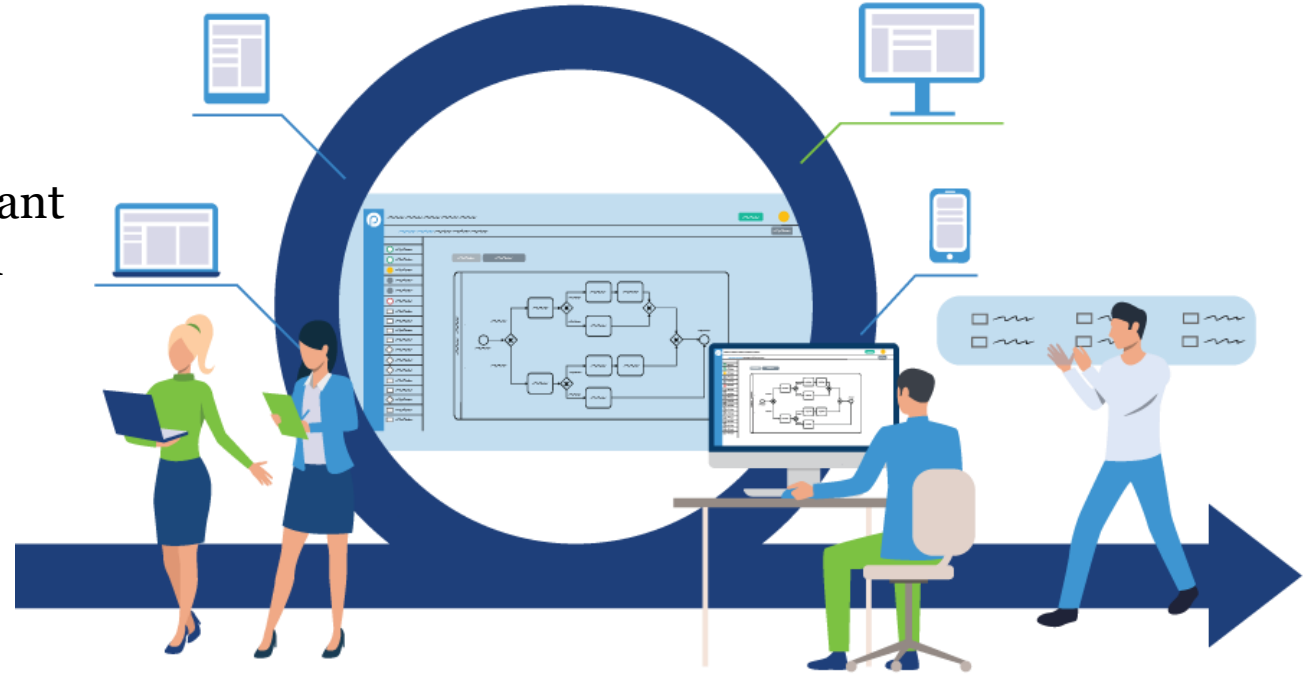
Relevance of the Problem

- The problem of blockchain-driven cross-organizational business process modeling, versioning, and executing was considered in multiple resent studies
- Thanks to the blockchain, inter-organizational storage of tokenized business process models may provide collaborative parties with the proof of authorship, censorship resistance, timestamping, and immutability
- Therefore, the problem of business process model tokenization remains relevant and respective information technologies should consider latest trends of blockchain technology and digital economics



Purpose and Objectives

- The problem of business process models tokenization, i.e. representation of them as digital tradable assets on a certain crypto-platform, must be solved to reach considered BPM (Business Process Management) driven tokenomics

- The object of this research includes sharing and exchange of business process models

- The subject of research is the approach to business process models tokenization using blockchain and smart contracts

Blockchain, Smart Contracts, and Tokenization

- The term “blockchain” means an immutable or read-only data structure – a linked list of blocks, a directed acyclic graph (DAG), or a tree-like data structure, in which new data can be only appended at the end of chain

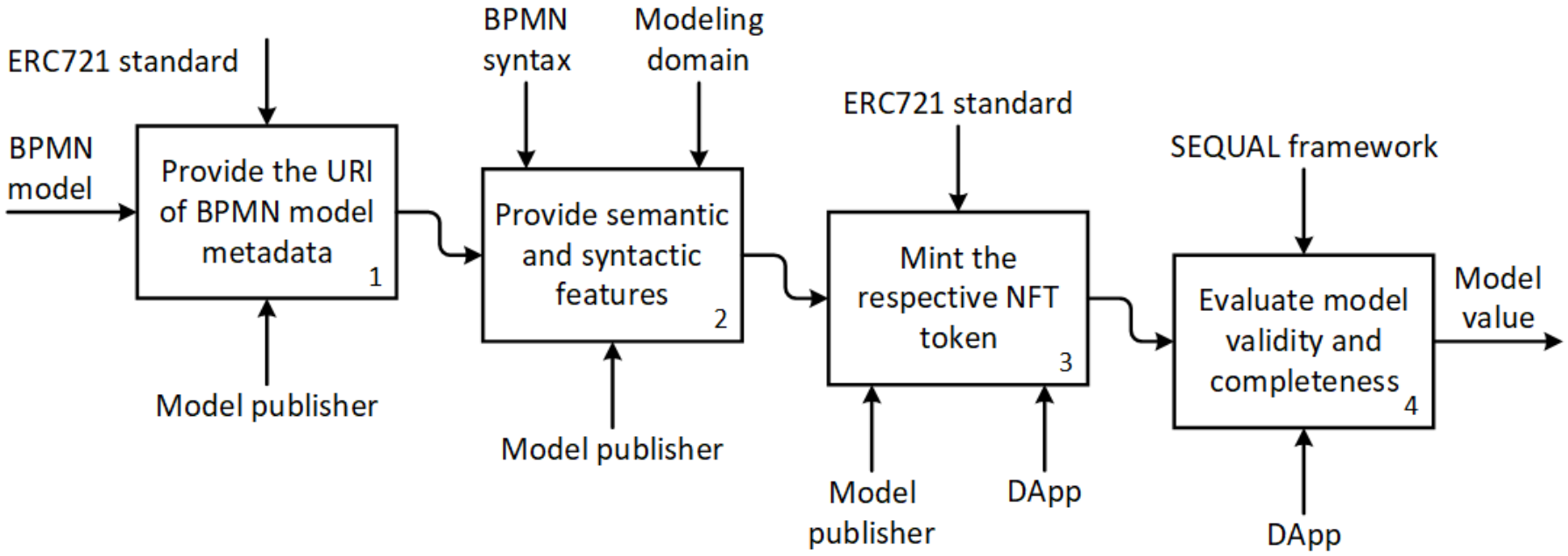
- Smart contracts are immutable programs publically stored on blockchain, also referred as decentralized applications (DApps) performing exactly as they were developed, without possibility of fraud, downtime, censorship, or interference

- In the context of blockchain, tokenization means representation of real physical or electronic assets (commodities, real estate, ownership rights for arts or other collectibles, currency etc.) digitally on the blockchain

- There are fungible (FT) and non-fungible (NFT) token standards exist: ERC20 and ERC721 respectively

Tokenization of Business Process Models using Smart Contracts

- The NFT token standard (ERC721) better suites business process models that are unique and unequal in terms of their syntactic and semantic properties, which could be used to define value of shared models
- There could be used SEQUAL (Semiotic Quality) framework for evaluation of syntactic and semantic validity and completeness of BPMN (Business Process Model and Notation) business process models given as graphic diagrams



Evaluation of Tokenized Business Process Models

- Each tokenized BPMN model should be described by: $\left\langle N^{synt}_{invalid}, N^{synt}_{incomplete} \right\rangle,$ $\left\langle N^{sem}_{invalid}, N^{sem}_{incomplete} \right\rangle,$
- Mapping should be noted: $Total : tokenId \to N,$

$Syntactic : tokenId \to \left\langle N^{synt}_{invalid}, N^{synt}_{incomplete} \right\rangle, \left(N^{synt}_{invalid} + N^{synt}_{incomplete}\right) \le N,$

$Semantic : tokenId \to \left\langle N^{sem}_{invalid}, N^{sem}_{incomplete} \right\rangle, \left(N^{sem}_{invalid} + N^{sem}_{incomplete}\right) \le N,$

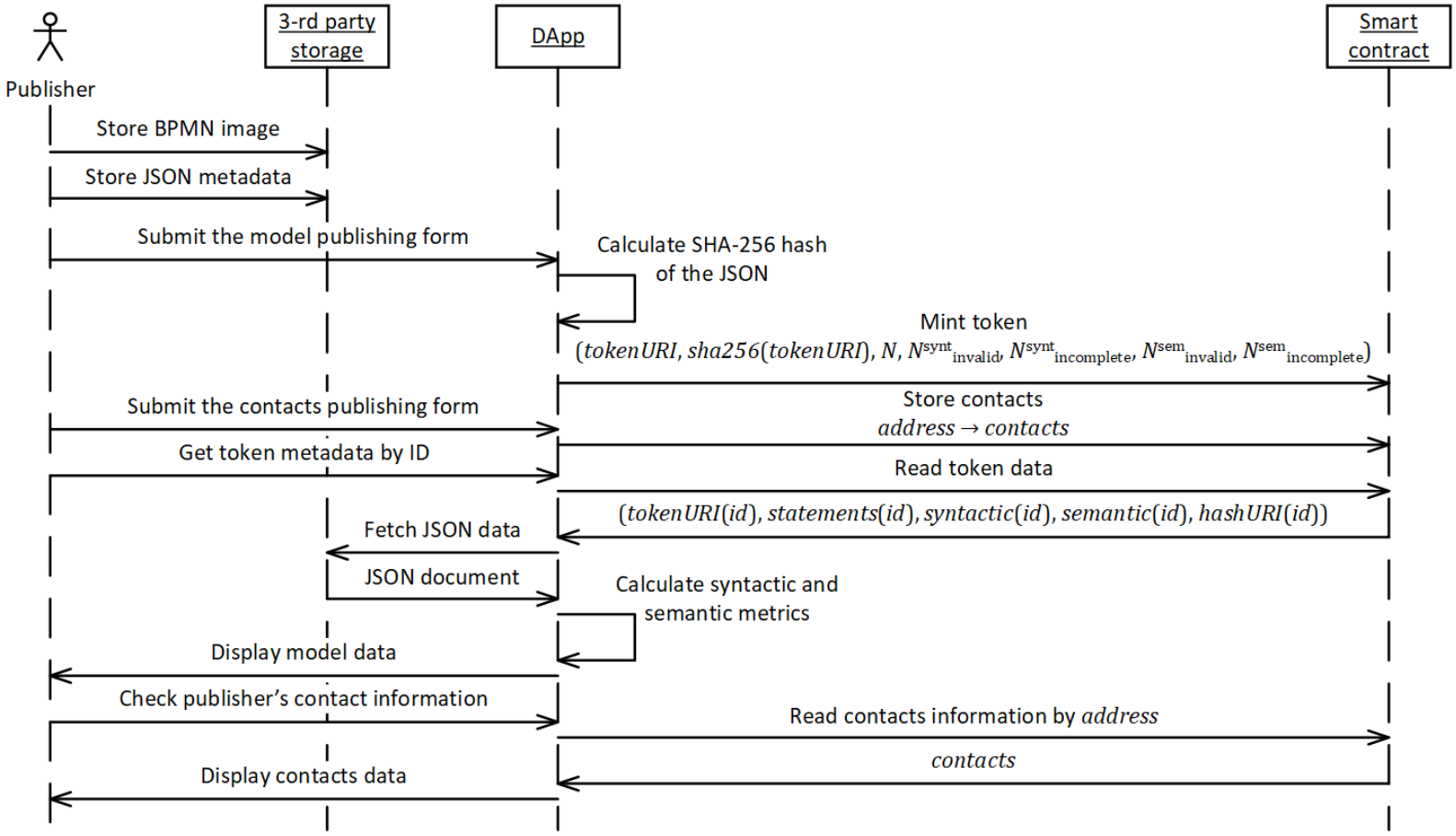
- Metrics should be calculated then: $\text{Syntactic validity} = 1 - \frac{N^{synt}_{invalid}}{N},$

$\text{Syntactic completeness} = 1 - \frac{N^{synt}_{incomplete}}{N}, \ \text{Semantic validity} = 1 - \frac{N^{sem}_{invalid}}{N}, \ \text{Semantic completeness} = 1 - \frac{N^{sem}_{incomplete}}{N}.$

Linguistic value	Threshold	Color code
Good	≥ 0.8	Green
Satisfied	≥ 0.63	Yellow
Bad	< 0.63	Red

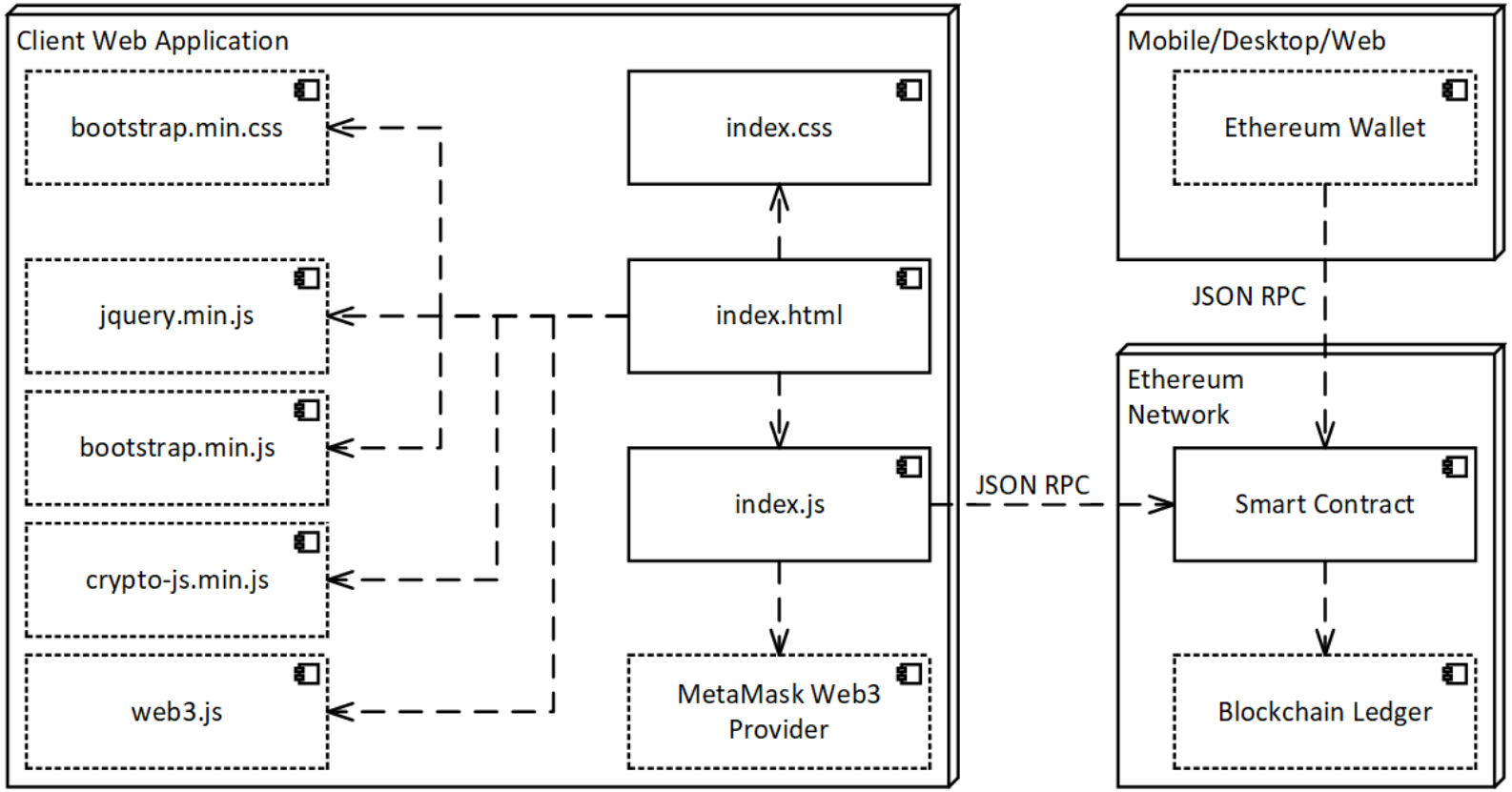
NFT-Compatible Smart Contract to Store Business Process Models

- The ERC721 standard should be extended with the following behavior: model and contacts data publishing (so parties can reach each other for collaboration)

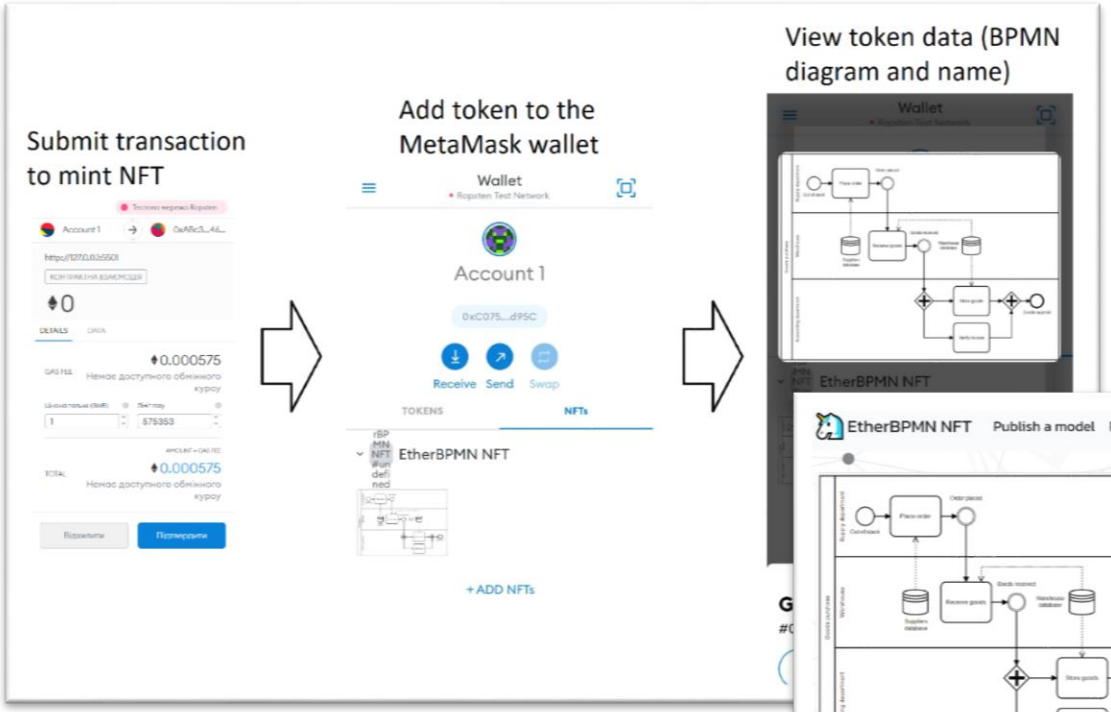


Design and Development of a Decentralized Application Prototype

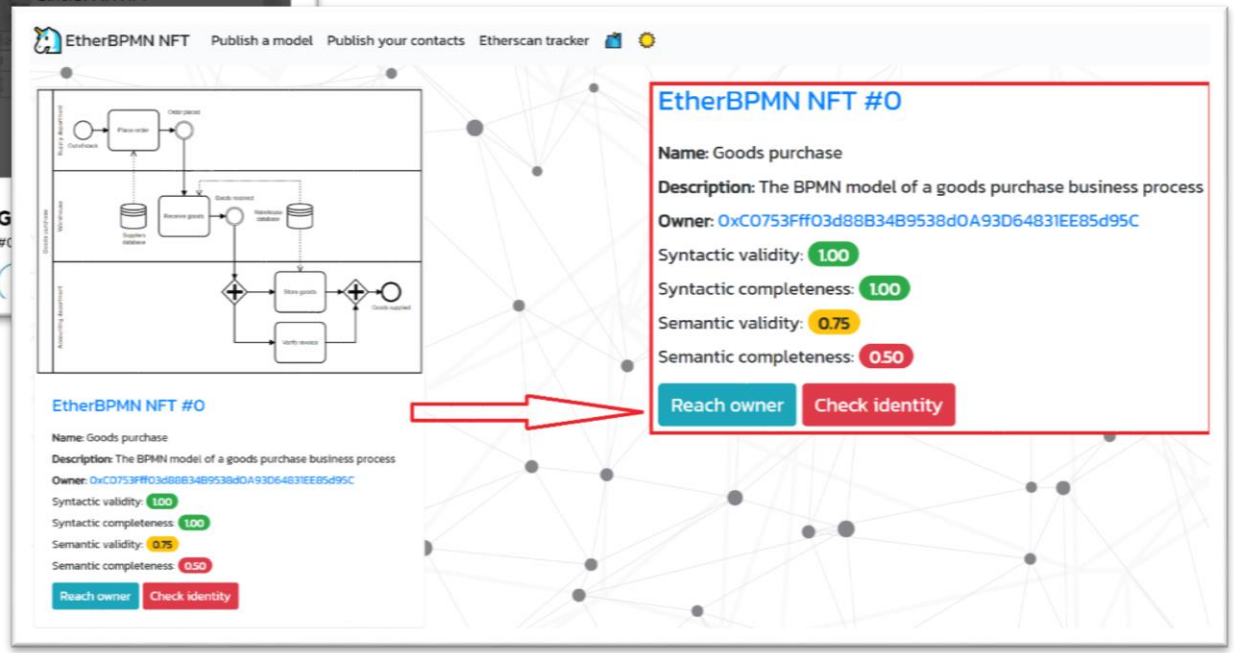
- System architecture of the DApp is similar to any client-server web application (e.g. HTML, CSS, and JS are still used for front-end), whereas instead of application server and persistent data storage the smart contract and blockchain ledger are used respectively



Validation of a Decentralized Application Prototype



Tokenized business process model in the MetaMask wallet



The homepage of developed DApp

Conclusion and Future Work

- Based on the performed state-of-the-art overview, the BPMN business process modeling notation was chosen to describe tokenized business process models as the most widely used and considered as the standard in BPM industry
- Based on features of NFTs, the ERC721 standard has been chosen, as well as Ethereum as the pioneering and still leading smart contracting platform has been chosen for DApp implementation
- Original ERC721 smart contract has been extended to keep syntactic and semantic properties of business process models, SHA-256 hash values of token metadata documents to ensure identity, and owner contact information to ensure collaboration of parties
- Developed DApp prototype allows to publish a model as the NFT, review already published NFTs, including model names, descriptions, BPMN diagram images (preview and full size), quality metrics, owner addresses, request owner contact information (if provided), check identity of tokenized BPMN models, and share own contact information if necessary
- Future work in this area includes development of the decentralized marketplace and exchange for BPMN models as NFTs, as well as more rigorous evaluation of tokenized business process models by means of special methods and algorithms, rather than human judgment

THANK YOU FOR YOUR ATTENTION!