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COST ESTIMATION OF BUSINESS PROCESS MODELS TOKENIZED USING BLOCKCHAIN AND NFT TECHNOLOGIES

This paper considers a problem of peer-to-peer exchange of business process models that represent valuable enterprise knowledge assets. It considers the use of blockchain technology and the tokenization technique for decentralized storage and exchange of business process models and NFT (Non-Fungible Tokens). A proposed cost-estimation technique is inspired by the COCOMO (Constructive Cost Model), widely used in the software engineering field.

Enterprise management is currently following the trend of digital transformation. First and foremost, business process management (BPM) and its applications in business process modeling and automation using BPM suites are linked to digital transformation. Business process modeling is used for more than just creating executable workflows, as they are typically sufficiently simplified and represent essentially standard document flows.

Business process modeling's primary objective is to identify and comprehend ongoing workflows by visualizing them as graphical diagrams, finding bottlenecks for improvement, and facilitating communication between IT-workers (Information Technology) and business stakeholders. Organizations adopt and modify common reference models of corporate business processes based on market demands and internal requirements.

Organizations with the greatest levels of BPM maturity contain huge collections of business process models that are tremendously valuable to both them and their rivals. Hence, successful and tried-and-true business situations captured as process models could be marketed to other businesses eager to reap the benefits of BPM. Blockchain technology, including cryptocurrencies and smart contracts, could be used to coordinate the peer-to-peer sharing of business process models in a secure manner. To achieve such BPM-driven tokenomics, the tokenization of business process models, or their representation as digital tradable assets on a particular crypto-platform, is the only issue that needs to be resolved [1].

Tokenization in the context of blockchain refers to the digital representation on the blockchain of physical or digital assets [2]. Commodities, property, ownership rights to works of art or other collectibles, money, or any other sort of asset could

be included. Flexibility, decentralization, security, and transparency that tokenization offers are advantages of this technology [2], but there are also drawbacks including regulatory and legal concerns, as well as technical obstacles brought on by the use of DApps (Decentralized Applications).

Business process models that are different and unequal in terms of their syntactic and semantic characteristics fit the NFT (Non-Fungible Token) better and could be used to define the worth of shared models [3]. Before NFT is minted (i.e. published on the blockchain) and added to a marketplace, the cost of corresponding business process model should be estimated to define its value for collaborating parties [3].

Formally, a BPMN (Business Process Modeling and Notation) business process model can be described using the coherent, directed graph [4]:

$$G = (N, F), \tag{1}$$

where:
– N is the set of business process elements (activities, events, gateways, etc.);
– $F \subseteq N \times N$ is the set of sequence flows connecting elements.

Authors of paper [5] propose the modification of the Constructive Cost Model (COCOMO) for cost estimation in process modeling similarly this model is used in software engineering. According to this study [5], the average LOC (Lines of Code) of a BPMN element is 7.

Therefore, the cost estimation of a business process model can be found using the following equation:

$$Cost = \left[a \cdot \frac{(s \cdot |N|)^b}{1000} \right] \cdot h \cdot w, \tag{2}$$

where:
– a and b are the factor and the metric number respectively, e.g. for easy projects $a = 2.4$ and $b = 1.05$ [5];
– s is the average LOC of a BPMN element, $s = 7$;
– $|N|$ is the number of business process elements, see equation (1);
– h is the number of hours in a person-month according to COCOMO, $h = 152$;
– w is the hourly wage of a business process modeler, let it be 56.06 U.S. Dollars according to ZipRecruiter.

The sample BPMN model of a goods purchase business process used in this study for experiments includes [3]:
– 1 start event;
– 4 tasks;
– 2 intermediate events;
– 2 inclusive (AND) gateways;
– 1 end event;
– 10 sequence flows.

Hence, the number of business process elements is $|N| = 1 + 4 + 2 + 2 + 1 + 10 = 20$. The considered BPMN diagram is given in Fig. 1.
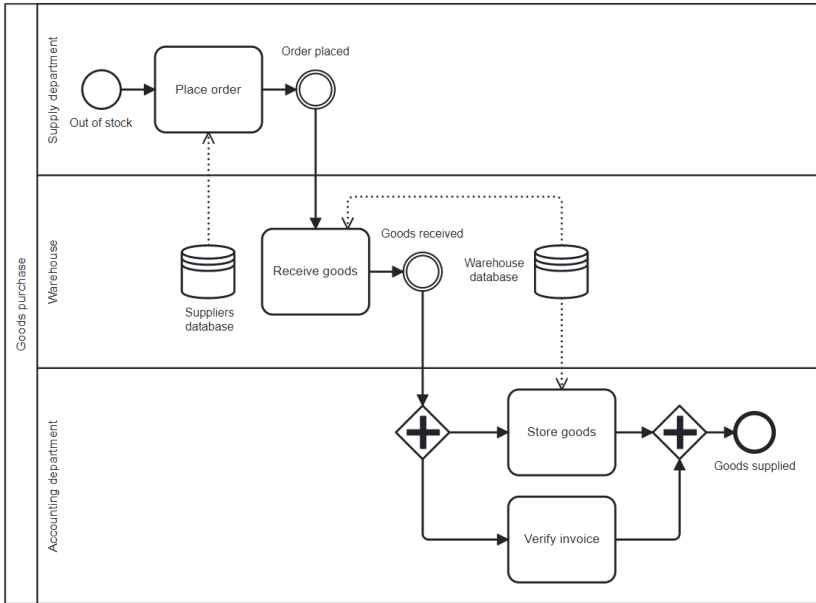
Fig. 1. The BPMN model of a goods dispatch business process

The considered properties were set when the corresponding NFT was created in the OpenSea marketplace (Fig. 2).

Fig. 2. Setting up the NFT properties

The estimated cost of a business process model given in Fig. 1 was calculated using equation (2) as 2595.03 U.S. Dollars. Therefore, the NFT price in a collection of 1000 items should be adjusted to approximately 2.6 U.S. Dollars. The example of listing a tokenized BPMN model in OpenSea is demonstrated in Fig. 3.
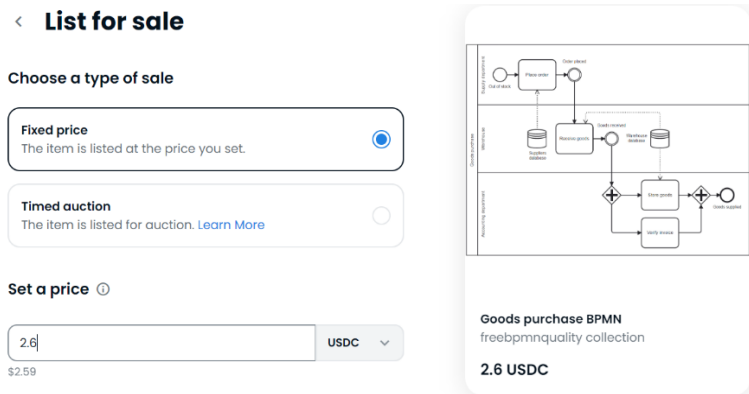

Fig. 3. The NFT price adjustment in OpenSea

The experimental results demonstrate the estimated cost for a relatively simple BPMN model is too high. This means the proposed model (2) should be refined, as well as minting of NFT collections instead of a single item should be considered to provide multiple stakeholders with the ability to purchase the same business process model. Furthermore, a web service should be developed to automatically evaluate business process models tokenized as NFTs and adjust their price.

References:

1. Hines, B. (2020). Digital finance: Security tokens and unlocking the real potential of blockchain. John Wiley & Sons.

2. Bashir, I. (2020). Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more. Packt Publishing Ltd.

3. Kopp, A., & Orlovskyi, D. (2022). Towards the Tokenization of Business Process Models using the Blockchain Technology and Smart Contracts. CEUR Workshop Proceedings, 3137, 274-287.

4. Kopp, A. M., & Orlovskyi, D. L. (2019). A Method for Business Process Model Analysis and Improvement. CEUR Workshop Proceedings, 2403, 1-10.

5. Baumann, F., Milutinovic, A., & Roller, D. (2016). Software engineering inspired cost estimation for process modelling. International Journal of Economics and Management Engineering, 10(2), 576-586.