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Blockchain Invoicing for Government Services

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Abstract. Blockchain technology is known primarily through the cryptocurrency bitcoin, but it has begun to find application in other areas for both public and private services, including, but not limited to, payments, electronic voting, health, government services etc. Blockchain technology potential relay's on its capability to store all transactions records and makes them available to all parties with permission to view, but no one can make unauthorized changes to them. Many government service providers bill the government for the services they provide, but non-standardized and unverified manual or electronic invoicing often leads to double invoicing or payment. As a result of these problems extra care and controls are needed to avoid generating double invoicing or payments. This paper analyses the implementation of blockchain and smart contracts for invoicing efficiently government services. Furthermore, the paper analyses several government services and authorities and determine the type of blockchain to be used. Implementing blockchain and smart contracts eliminates not only the double invoicing and payments issue, but it also can transform the process, i.e. increases the transparency of invoicing and payment of services, thus offering better audit opportunities.

Keywords: Blockchain, Invoicing, Government Services, Smart Contract

1 Introduction

Public services are usually largely provided by governments and government institutions or public institutions. Public services include services provided by government to people and institutions, but also people or businesses performing services to government and government institutions. For services provided by businesses or individuals to the government they bill the government by issuing invoices. Invoicing procedures are often very bureaucratic and time consuming because they have to be submitted and processed in various government offices, as a result they

may be delayed from being executed. Even non-standardization of billing for the same services can cause different difficulties or even errors in billing. Frequent invoicing for the same services can cause forgetfulness in invoice generation or even send the same invoice more than once. To eliminate these difficulties and possible errors, electronic invoicing must be implemented through the use of technology. One of the new technologies that is being used very recently is Blockchain technology. The advantages of implementing technologies are various and numerous, such as savings in time, shipping and personnel costs, reduced material costs, and faster payment due to faster processing, reduction of input errors, simplification of archiving, less paper consumption and many others. It is human to make mistakes when processing work, but it is also human to apply smart and automated solutions to certain tasks. Automation and efficient implementation of bill management and payment can be done through Blockchain technology by implementing so-called smart contracts which can not only solve the issue of billing and double payments, but can also transform the process, increase transparency of billing and payment of services and provide better audit opportunities.

2   Literature review

An invoice can be a physical or electronic document issued and sent by the provider of a product or service to a buyer. In other words, the invoice is a written verification of the agreement between the buyer and the seller of the goods or services.
Most customers today use a complicated procedure for processing supplier payments to ensure that the process is not only accurate and complete, but also in accordance with the terms of the trade agreement, carried out in accordance with the terms of the contractual agreement, to be carried out with proven trading partners, to ensure that it is not fraudulent or illegal in any way and is fully auditable.

There is a lot of research on blockchain in the field of finance, but not concrete research that has dealt with billing through blockchain. However various aspects of invoicing have been analyzed, such as Blockchain-based risk mitigation [1]. The authors [2] also propose the use of blockchain for value added tax, and the authors [3] have proposed the use of blockchain in invoicing discounts. Another aspect that has been addressed for blockchain invoicing is about the factoring of invoices which has been done by the authors [4]. An overview of blockchain-based applications has been published in [5]. The authors' research [5] presents an overview of blockchain-based applications across different sectors in almost all areas of life, including supplies, healthcare, various business processes, finance, government services, and more. Blockchain is used in different fields and has different divisions and classifications, but some divide blockchain into financial and non-financial blockchain [6]. This is because cryptocurrencies are implemented through blockchain and represent a significant percentage. For the blockchain model and the use of smart contracts, the authors [7] have also taken in their research on maintaining privacy through smart contracts. To prevent double funding or double invoicing using Blockchain technology have also researched authors [8]. Another similar approach has the authors [9] in their work on

preventing double spending. A recent study also addressed the blockchain invoice cloud platform to study its relationship to high quality enterprise development [10].

3   Blockchain

Blockchain is a new technology which has aroused great interest of the scientific community, business and individuals. This technology is finding great application in many fields and has so far found application in finance. It can be said that Blockchain is a specific type of database where data is stored in each block. This type of database does not have just one database control and management center as is usually the traditional database, hence due to management by many participants it is known as Distributed Ledger Technology (DLT). Blockchain is a new technology that is presented through blocks or a chain of blocks, where information is stored in each block, so it is not a traditional chain, but an information chain [11]. The first system based on blockchain was developed by Satoshi Nakamoto and its use was with Bitcoin [12]. Blockchain technology is defined as a decentralized, distributed ledger that records transactions in blocks that are joined together in a chain. The advantage of blockchain compared to other technologies is that the data in blockchain cannot be modified, therefore blockchain is immutable. In other words, blockchain is a distributed book across blocks that provides fully audit mechanisms. Through blockchain, information can be distributed to authorized members in an easy, ideal and completely transparent way that creates good control and audit mechanisms.

Each block stores information that contains transaction data, but also some other data that are time stamps and a kind of string called hash. Hash is stored for the block (itself) but also for the previous block and is a unique value as presented in Fig 1.
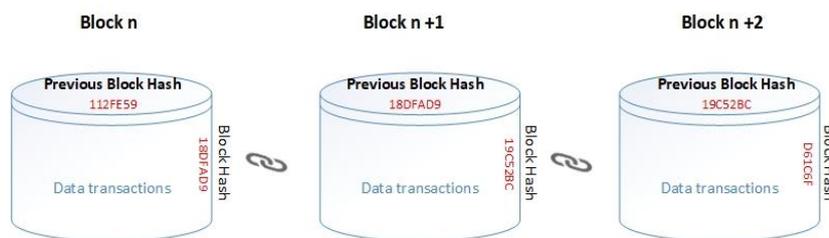

Fig. 1. Blockchain blocks

Since each block in addition to its own hash is also storing the hash of the previous block, this enables the blocks to be linked in a chain and at the same time prevents new blocks from being changed or inserted between existing blocks [13]. Based on the links of the blocks in the chain, each block has only one parent, but may have more children. But in the case where the block has more child blocks, then all the blocks called children have the same parent [14].

Depending on the needs and requirements of the system, blockchain can be public, private or mixed. As we said earlier, Blockchain can be used in many areas and can be

both public and private or even mixed, but usually in the case when used for government services it is a private network with known identities and limited participation.
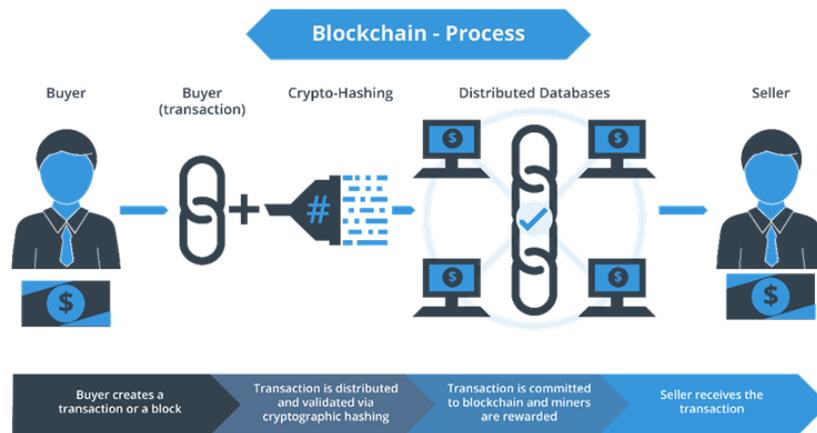

Fig. 2. Blockchain process **[15]**

4 Invoicing

Many years ago for each service the citizens had to be physically present at the counters to perform any kind of service related to the government, both in the administration and during the invoicing. Such a thing nowadays is meaningless when considering the great development of technology, but also the great movement of citizens and services. Therefore, in order to respond to the great economic and technological development, there is a need for the modernization of the systems in general. This modernization of systems should also find application in the field of invoicing by modernizing invoicing systems from traditional paper invoicing systems to electronic invoicing based on new and secure technologies.

Electronic invoicing can be organized in many forms, but to have more transparency, security in terms of immutability, blockchain is one of the solutions. Various studies show that blockchain-based invoicing systems can offer different solutions than traditional paper-based or even electronic invoicing without blockchain. In centralized payment systems, with all their advantages of real-time payments, they still have their drawbacks at the moment when we are dealing with the dependence of payments on other systems. In these cases, there are delays in verification and in many cases problems which must be resolved through the courts, due to non-communication of systems as a result of dependence on each other, for example to order something from a seller who does not "*know*" us. You can place the order if you pay in advance the value of the order, but if the buyer does not "*know*" the seller is a risk if payment is made without accepting the goods. In these cases, intermediation can be used through

the bank, where the bank issues a guarantee that if the goods are accepted and the buyer does not pay, then the bank makes the payment. To avoid all these processes which cost both time and money (since the bank does not issue interest-free guarantees), then the solution is blockchain payments using smart contracts.

Today, sustainable development, greenhouse gas effects and climate change are among the major challenges faced by the mankind, and many organizations, such as financial institutions, are looking to both save money and reduce their carbon footprint [16].

The process of a service from the Purchase Requisition till to the confirmation of payment can be largely similar, but there may be other stages or any of the these presented in Fig. 3.

Fig. 3. Process of expenditures

When ordering goods, a smart contract is initially created between the buyer and the seller, and payment is not made until the goods are received. Upon receipt of the goods, payment is made through smart contracts. In this case, in addition to saving time, we also have money savings, and also greater security, as there are cases when a seller does not trust the "bank" of the other state, and on the other hand neither the state bank the seller does not trust the buyer. Cross-Border payment continue to be expensive. It difficult to assess and deduce charges incurred through multiple correspondent bank. The identity of involved banks is not always known between seller and buyer [17]

From the elaborated example, we conclude that the use of decentralized systems, in this case blockchain and smart contracts, eliminates many barriers in terms of billing and payments. In such a digital environment, the advantage that should not be left unmentioned is that it also affects the non-increase of prices to the final buyer, since every business has a profit margin. The above example presents cases of purchases of material goods. In this age we are, many things can be bought which are not materially. For example, different software, different services, consultations, etc. Billing and payment of such purchases using blockchain can be said to be done in the order of minutes, as there is no need for intermediation as in the case of bank guarantees, which can last for days or even weeks.

Payment for an order must be made through minimum two banks as intermediaries in best case, but usually these kind of payments it is difficult to be realized without and extra intermediaries bank between exporters and importers bank, or any other third

parties' payment institution, like SWIFT or Visa, or both of them. The existence of multiple en route handoffs of the goods between the different carrier organizations involved in the shipment of the goods increases the complexity of the invoice generation process. The most common payment method is open account, where the goods is shipped and delivered before the release of funds from the shipper within an agreed time frame [18].

Applying blockchain in payments system and use of it in international manner, all of the intermediaries as layer between exporters and importers will be not any more needed. This kind of architecture increases not only the speed of execution but also ensure the protection from fraud in one side and decrease the fee cost in other side. One of the biggest risk in financial invoicing is the fraud. The concern of invoice legitimacy is put an end with use of distributed ledger technology. With the smart contracts technology, the letter of credit issued by the bank is eliminated, by removing the need of human interaction in payment execution or payment claim demand.

The first system in the world that use blockchain for invoicing can be considered the trail transit invoice in Futian Metro Station in Shenzhen in China on 18 Mar. 2019 [19].

By combining blockchain technology, an electronic invoice alliance chain can be built based on the Internet-based alliance [20]. Except the advantages mentioned still there are in the current status of blockchain presents some limitations for some aspects: The throughput: it is not possible today to share millions of invoices per second, Open banking: this domain is new, only a few banks propose a delegation of powers such as the initiation of transactions, there are tradeoffs to make between centralized privacy and a completely decentralized finance infrastructure [21].

5   Conclusion

Blockchain technology has the potential to improve many systems used by government and one of them can be blockchain invoicing. Some institutions already have started using this kind of technology or have experimented. The main benefit of passing invoicing systems to blockchain is the added level of transparency that blockchain allows. Blockchain will prevent fraudulent providers from providing many times because their invoice is recorded and guaranteed by the cryptographic functions. Altering one block affect all blocks in the chain, thus assuring immutability of the invoicing. Recording invoice in the blockchain are not only immutable and transparent but also available in quick time making invoicing not only secure but also efficient.

With blockchain technology, data is stored on many servers, so it is much more difficult to destroy or alter invoice by hacking than a single centralized system. The blockchain technology is still in its early stages, but blockchain has the potential to revolutionize the way transactions are verified, how invoices are issued, and how and when payments are made. It can therefore be said that the features offered by Blockchain can be combined and customized and there are many possible scenarios when blockchain can be used for issuing invoices while saving time, eliminating double invoicing and double payment.

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