

# Audit of the European System of Accounts Based on Blockchain Technology

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## Abstract

European Union, permanently add value and one from the multiple directions is the harmonization process of national accounts. In 2010 the European System of Accounts (ESA 2010) continue the development of this process ([DINICA, MIHAI, & ISAI, 2019](#)). The most probable scenario is using Blockchain technology in developing ESA 2010 and the audit of this implementation is more than an challenge. Pursuing these theories from an exploratory point of view, in our professional opinion, the following development of ESA 2010 will be close enough to predict the future of this field of science.

## 1. Introduction

Defining in few words the newest accounting framework (ESA 2010) ([European system of accounts ESA 2010, 2019](#)) as an international and EU compatible concept, in order to describe, in a more systematic and detailed way the EU economy or global economy it is not enough. European System of National and Regional Accounts it is not only a set of rules which will be followed by the Member States but is the concept that adds real value to the entire EU economy.

It is difficult to see the beauty of the landscape from the base of the mountain, much effort will take to climb the mountain but in the moment you rich the top you will see the entire picture and this is the entire concept of adding value. Of course that the hard work is the source of a continuous process of adding value but at the end, the last piece of the puzzle, will complete the entire image and will give sense to the entire effort, sometimes in an invisible way.

Let's imagine that ESA 2010 is based on Blockchain technology ([Policy Blockchain Technologies, 2020](#)). I made, myself exercise of imagination, after Commission decision to create together with the Member States the European Blockchain Partnership (EBP) in order to develop a trusted, secure and resilient European Blockchain Services Infrastructure (EBSI) ([The European Blockchain Services Infrastructure is on its way, 2020](#)). In December 2019 European Commission started an open market consultation and I believe that my exercise of imagination could be, maybe, a small part of a beautiful global solution.

And above all, the Audit of the entire system will complete the picture, and the meaning of the adding value concept has sense and bring assurance that an adequate level of accuracy is achieved.

## 2. European System of Accounts (ESA 2010)

In this moment there are enough differences between National Accounting Systems that in order to achieve fundamental objectives of the European Union and to underline the economic and monetary union, it is necessary not only high-quality statistical tools but a complex set of rules to establish a common accounting instrument and system, with reliable results and adequate accuracy, providing to Union Institutions, governments, economic and social operators, to base their decisions.

In fact, these specific rules, require greater accuracy in the accounting rules, definitions and the way of the aggregation of the national accounts in order to be comparable between the

Member States. In my thesis I take into consideration all rules of the above-stated document but in order to simplify or from representation reasons I choose only the parts which best serves the thesis argumentation.

### **3. Blockchain Technology**

At this moment may we consider that Blockchain Technology is an important step for the future development of all fields of science? I think we do. I discovered the huge potential of Blockchain Technology in 2010 but adding value it looked like a mission for tomorrow ([Blockchain Now And Tomorrow, 2019](#)). Starting from 2015 the real interest take place of the untrusted positions and developed overnight series of new theories and approaches.

Now I am considering that there is a future of digital assets ([Blockchain and the future of digital assets, 2020](#)) and these future digital assets ([Blockchain and digital assets, 2020](#)) are tightly related to Blockchain. Using Distributed Ledger Technologies (DLT) in my thesis was a natural step in sharing the huge impact on the economy and the great potential to bring improvements at all levels of society. Not only the industry will profit from this but the citizens too.

These technologies, Blockchain and DLT's, can lead to new approaches and strategies which will provide to administrations digital services and assets. From these new improved business models will benefit the entire society and the value-added-centric concept will stimulate sustainable economic growth.

### **4. ESA 2010 based on Blockchain Technology**

Starting from the accounting set of rules ESA 2010 I had imagined a very futuristic scenario of how I'll be able to improve this using DLT's and after creating this new accounting system how I'll be able to audit the system. I started first with a non-conventional approach but finally I ended using academic style, at least a few parts of my dissertation thesis.

Beyond the academic rigors, the starting point of all these is Bitcoin ([Bitcoin: A Peer-to-Peer Electronic Cash System, 2020](#)), which has a non-conventional approach from the day it was published. It takes some time until the academic world takes seriously an anonymous article published on the internet. Maybe it is not pure science but it changes the world we know. And, maybe, it is not about a millennium discovery but is the recipe of putting all together.

I started looking from a convenient type of transaction, more exactly a new concept of transaction which will combine the rules of accounting with a peer-to-peer system. I figure out that small modifications can transform ESA 2010 in a singular accounting application but this kind of application may be operational only with the support of the Member States of the European Union.

The next modification was to peer-to-peer system which remains decentralized but governed by a central institution that fits perfectly with the European Commission as governor and decentralized parties like the Member States. In these circumstances a new modification is necessary in order to properly function the system. The system needs operators. As many operators is it possible. At the beginning the operators will be qualified but finally everyone will be eligible to participate.

Taking into consideration that the system has all the operators it needs is the moment when I underline the importance of an adequate procedure to validate data. In this situation, new modification is required to have a system with validated information, accepted by all parties.

Finally, a small modification of Blockchain will provide the unique ledger with all transactions, with all details, existing decentralized and, easy to access. Transparently, every single transaction will be available, with all details, for all interested parties. The unique Blockchain ledger will be available as a whole or as blocks depending on user necessities.

Must be reminded as a conclusion, not as a condition that calculation power and storage capabilities will be an indicator of necessary hardware and software but with the actual rate of development the cost to participate in the system will not be so high. Every participant/operator to the system will receive one or multiple roles.

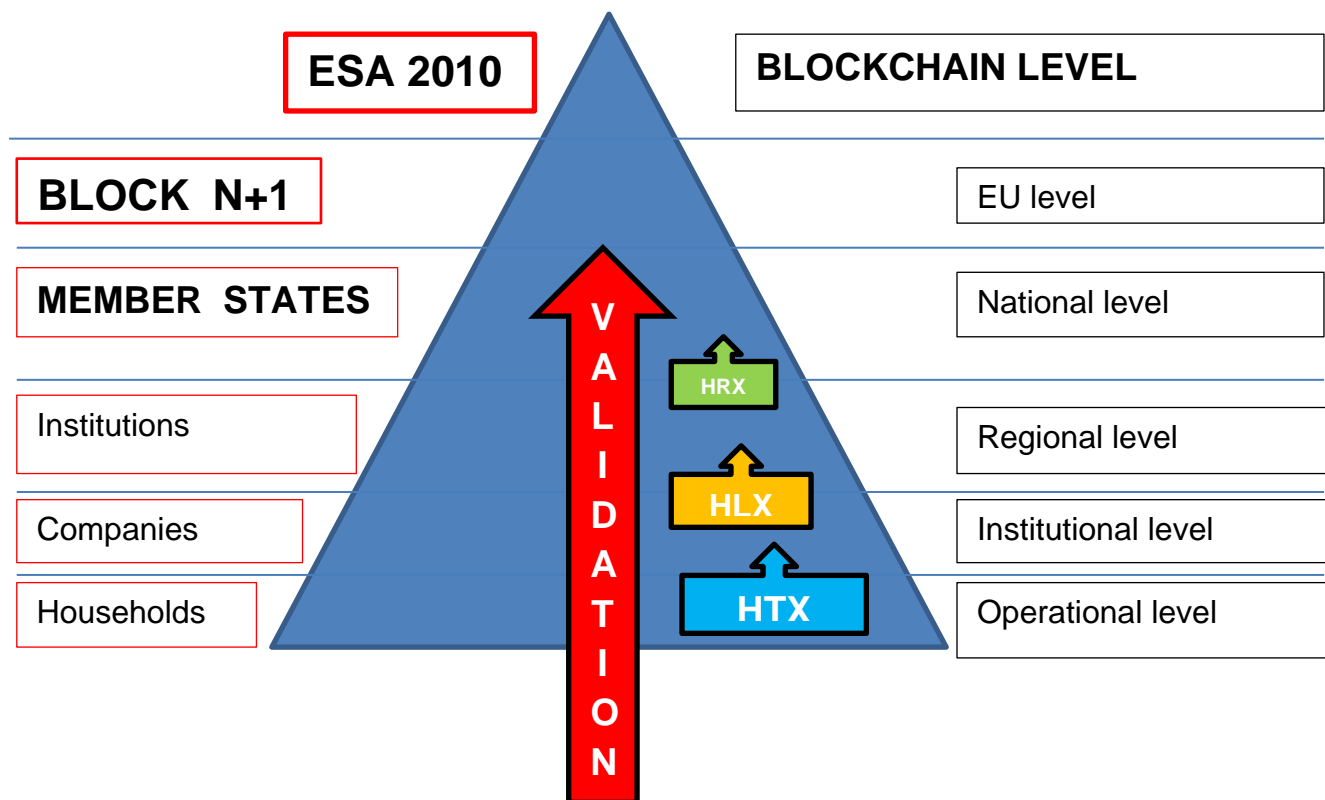


Fig.1. Implementation pyramid

### Operational level

At this level, the economy is operating and is created from my point of view the basic economic operation. At the same time take place the corresponding action which will create the proof documents or legal documents. In all cases the most important objective at this level is to create the **electronic transaction Tx**.

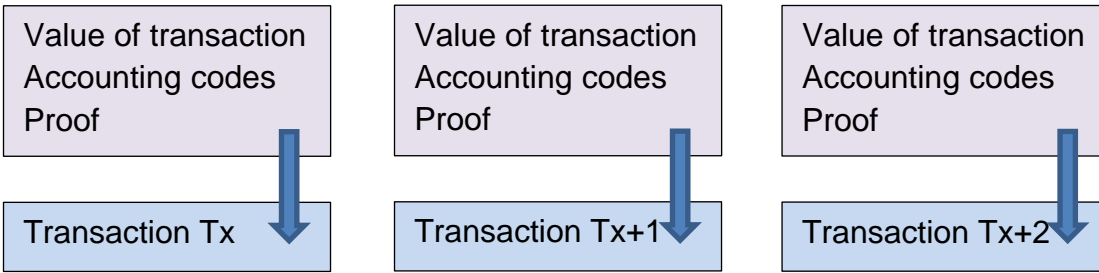
The central element in the transaction is **transaction value** which can be positive or negative. The next element is a list of accounting codes, not like an accounting formula but a codification sequence containing information about accounting systems like credit or debit.

Electronic transaction Tx has attached or included the proof document. That means every transaction must contain the proof or a codification of proof. All these elements create a package called transaction.

### Institutional level

At this level, transaction Tx is verified and as a result of compliance transaction is validated. This transaction with one validation is sent to nodes/operators to receive more

validations. According to a validation algorithm, each fully validated transaction is sent to the next level.

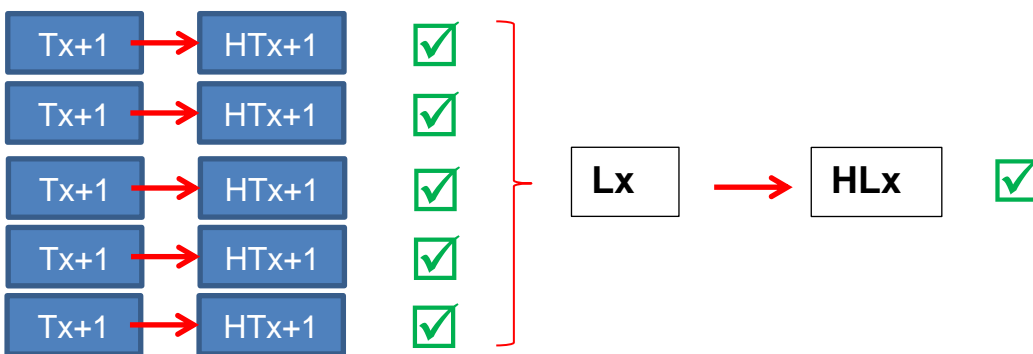


In this way, each transaction receives validation from different institutions, operators, or multiple users. In other words, the system has the first control level not only the validation level.

**Regional level**

This is the processing level, where the first process is to calculate the hash function of each transaction. I called the result **Hash Tx (HTx)**. The next process is to filter HTx according to specific criteria and validate the list. Validated lists are sent to nodes/operators to receive more validations according to a validation algorithm.

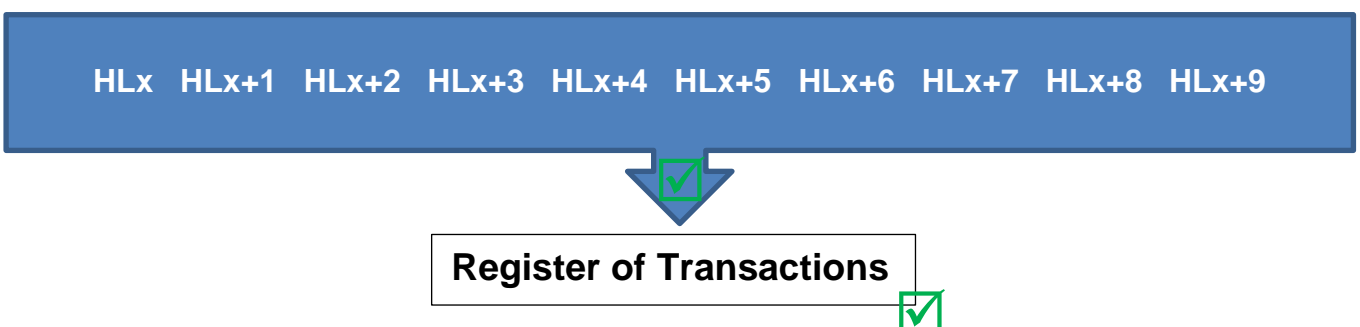
A fully validated list is eligible for the next process consisting of a hash function calculation. I called the result **Hash Lx (HLx)**. All HLx are sent to nodes/operators for the next level.



**National level**

At this moment HLx passes through a second control level. According to a register creation algorithm the register of transaction is created. The next step is to calculate the hash function to a register. I called the resulting **Hash Rx (HRx)**.

Now is initiated the block, which is the basic unit link in our chain and sent to nodes/operators for validation, at this level means the Member States. Also, there is possible to make some aggregation and calculation at this level. After block validation must be sent to the next level.



## EU level

This is not the final level this is the certification level. The initiated and validated block is completed with a timestamp, accounts certificate, and the hash function of the previous block (HBx-1). Now the block is sent to all the Member States for validation.

The block validated by all Member States is part of **ESA 2010 Blockchain** ledger and official transactions are executed and the system automatically reports the results, aggregations, and statistics.

## ESA 2010 Blockchain level

This is the final level, where the ledger is stored in multiple locations in a decentralized manner to all interested parties. It can be stored all blocks of the chain or only separate blocks. Now all economic transactions from the EU are registered.

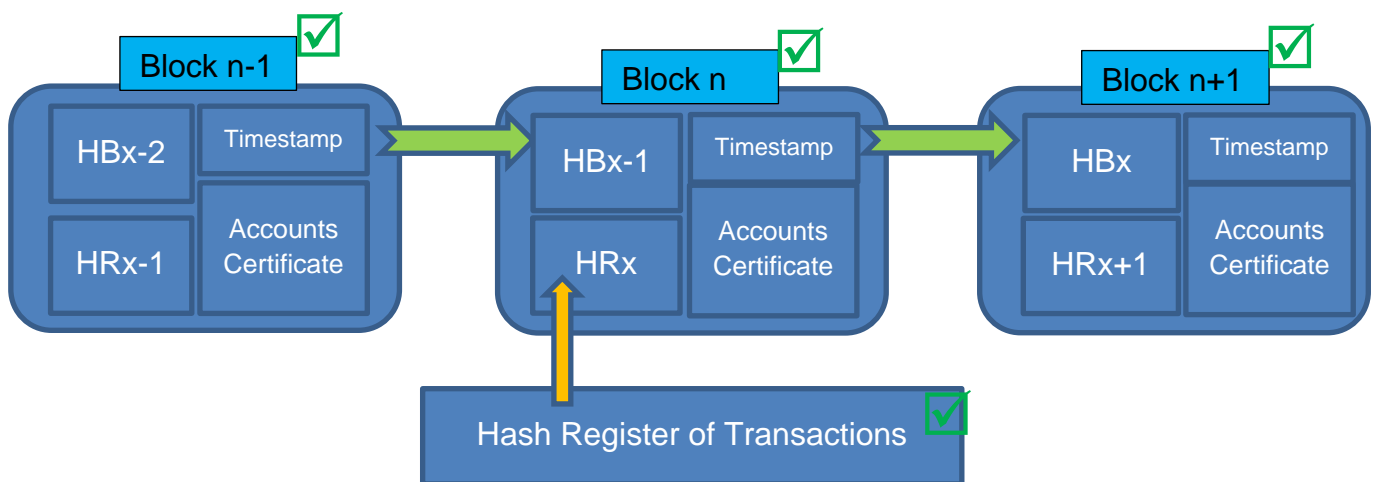


Fig. 2. Blocks structure of ESA 2010 Blockchain

## 5. Audit of ESA 2010 Blockchain



As a last confirmation of the entire system ESA 2010 must be audited. This process itself adds value but in these circumstances taking into consideration the complexity of the system it is strongly recommended to have an independent opinion not only about the system itself but about his vulnerabilities.

Every system is a potential provider of errors. I made few exemplifications of errors in my thesis but from the auditor's point of view some errors are not relevant. Despite all errors the risk of fraud remains an important threat.

Change management is part of the life cycle of the system. Always will be necessary improvements of the system and some corrective action must be implemented at some point.

## 6. Incentive

The incentive may help the system for a fast development in that way the operators from the pyramid base to process more and more transactions. This system can be highly automated but for the start, at least a few processes will be the task of human operators. As fast as the system will process information the reports will be close to real-time publishing.

Incentive plans were created for motivation to achieve better results. The best plans are tied to earnings but the most complex plans take into consideration performance, appreciation, reward, and recognition.

Now is a good moment that big players like the EU to adopt incentive plans as tools and to create advantages using ESA 2010 Blockchain. There is a risk that incentive plans cannot work (Kohn, 1993)? Maybe it is time to change this too.

## 7. Conclusion

There are some clear benefits to use this system, ESA 2010 Blockchain, not only due to each technology apart but from the whole system as an entire solution. This is an exercise of imagination that requires small modifications but accepted by important authorities. An important amount of time is necessary to pass until interested parties will consider that his idea is a step forward.

This might be a research paper but at the same time might be my acceptance of the future. Progress is about changing things, systems or models. The changing needs in accounting or economy take time but now I learned that all changes are technology-driven. After a few years, a new technology will be discovered, as disruptive as blockchain is today.

Including new technologies in old fields of science without adapting one to the other I think is impossible not only as a concept but also as practical representation. As far as we receive the same output but faster, with less effort, for the benefit of people and economy, I say it's about adding value.

Added value is not always measurable like VAT (Value Added Tax) but is about recognition. Every common people know that every day his work is part of a sustainable effort to add value to his home and family which is the household.

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