

## TABLE OF CONTENTS

<b><u>INTRODUZIONE</u></b>	<b>7</b>
<b><u>ABSTRACT</u></b>	<b>11</b>
<b><u>CHAPTER 1: THE NEW GENERAL FRAMEWORK OF THE REGULATION OF THE DISCIPLINE OF THE TRANSFER PRICING</u></b>	<b>14</b>
<b>1.1 OECD REGULAMENTATION A SHORT OVERVIEW OF ART 9 AND BEPS ACTIONS.</b>	<b>14</b>
<b>1.2 THE ESSENTIAL FUNTION OF INFORMATION IN THE BEPS</b>	<b>18</b>
<b>1.3 THE BEPS ACTION REGARDING THE VALUE CREATION</b>	<b>21</b>
<b><u>CHAPTER 2: THE NEW FRONTIER OF TECHNOLOGY, THE BLOCKCHAIN</u></b>	<b>24</b>
<b>2.1 BLOCKCHAIN A NEW GLOBAL ORDER</b>	<b>24</b>
<b>2.2 AUTENTICATION AND CORRECTNESS OF TRANSACTION (DIGITAL SIGNATURE AND HASHING)</b>	<b>32</b>
<b>2.3 THE BLOCKCHAIN DIFFICULTS: BYZANTINE GENERAL PROBLEM AND CONSENSUS PROBLEM</b>	<b>35</b>
<b>2.4 BLOCKCHAIN STEP BY STEP</b>	<b>41</b>
<b>2.5 THE PROBLEM OF THE FORK</b>	<b>45</b>
<b><u>CHAPTER 3: THE BIG SHORT: TRANSFER PRICING AND BLOCKCHAIN</u></b>	<b>48</b>
<b>3.1 TRANSFER PRICING: MISSING EXPECTATIONS AND TRUST?</b>	<b>48</b>

<b>3.2 BLOCKCHAIN AND ITS ANALYSIS: ADEQUATE, PRACTICAL AND RATIONAL.</b>	<b>50</b>
<b>3.3 THE ROLE OF TAX AUTHORITIES IN THE BLOCKCHAIN</b>	<b>53</b>
<b>3.4 THE IMPORTANCE OF SMART CONTRACTS: ADVANTAGES AND DISADVANTAGES.</b>	<b>55</b>
<b><u>CHAPTER 4: THE BLOCKCHAIN SYSTEM AND REGULATIONS REGARDING THE TRANSFER PRICING.</u></b>	<b><u>62</u></b>
<b>4.1 ARMS LENGTH PRINCIPLE</b>	<b>62</b>
<b>4.2 A DIFFERENT INTERPRETATION FOR EVERY COUNTRY</b>	<b>69</b>
<i>4.2.1 NETHERLAND</i>	69
<i>4.2.2 UNITED STATES</i>	70
<i>4.2.3 ITALY</i>	73
<b>4.3 WHAT IS THE PROBLEM? THE STARBUCKS CASE STUDY.</b>	<b>75</b>
<b>4.4 THE BLOCKCHAIN TECNLOOGY AND SMART CONTRACT AS A SOLUTION.</b>	<b>81</b>
<b><u>CHAPTER 5: THE SYSTEM AND THE ORGANIZATION OF THE BLOCKCHAIN.</u></b>	<b><u>86</u></b>
<b>5.1 ESSENTIAL CHARACTERISTICS AND IT IS POSSIBLE USE IN THE TAXATION SYSTEM.</b>	<b>86</b>
<b>5.2 PERMISSIONLESS AND PERMISSIONED BLOCKCHAIN.</b>	<b>88</b>
<b>5.3 THE BLOCKCHAIN CONSENSUS AND ITS PERFORMANCE.</b>	<b>92</b>
<b>5.4 THE RECCOMENDED CONFIGURATION.</b>	<b>94</b>
<b>CONCLUSIONS</b>	<b>98</b>
<b>BIBLIOGRAFY</b>	<b>102</b>

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## **LIST OF ABBREVIATIONS**

<b>ALP</b>	Arm's Length Principle
<b>APA</b>	Advanced price Agreement
<b>BEPS</b>	Base Erosion and Profit Shifting
<b>BFT</b>	Byzantine Fault Tolerance
<b>CCA</b>	Cost Contribution Arrangement
<b>CTM</b>	Complete Transaction Method
<b>CUP</b>	Comparable Uncontrolled Price
<b>CUT</b>	Comparable Uncontrolled Transaction
<b>EC</b>	European Commission
<b>EU</b>	European Union
<b>IP</b>	Intellectual Property
<b>M&amp;A</b>	Mergers & Acquisitions
<b>MAP</b>	Mutual Agreement Procedure
<b>MNE</b>	Multi National Enterprise
<b>OECD</b>	Organization for Economic Co-operation and Development
<b>POW</b>	Proof of work
<b>TNMM</b>	Transactional Net Margin Method
<b>WHT</b>	Withholding Tax

## **INTRODUZIONE**

Successivamente all'International Tax Week alla quale ho partecipato a Baarlo, il mio interesse nel fenomeno definito come Transfer pricing è aumentato ed ha fatto sì che la mia decisione riguardante la scelta della tesi di laurea ricadesse su questo argomento.

L'obiettivo fondamentale di questo lavoro è quello di analizzare il contributo che l'utilizzo di una nuova tecnologia come la Blockchain può dare nel campo della regolamentazione e gestione del Transfer Pricing e nella tassazione internazionale riguardanti le imprese multinazionali.

La Blockchain è una tecnologia che si può definire nuova ed emergente, propone un approccio nuovo alla gestione dei database, proponendo l'idea di un libro mastro distribuito, anche definito Distributed Ledger, nella quale i dati vengono memorizzati sui server che partecipano alla catena e dove il controllo non è più fornito da un'autorità centrale ben definita ma viene spostato a tutti i nodi della rete. Le caratteristiche principali di questo sistema hanno reso la ricerca molto interessante come interessante è la possibile applicazione di tale tecnologia nel campo della tassazione internazionale in questo caso più precisamente nelle transazioni infragruppo.

L'evasione fiscale ad opera delle grandi multinazionali e le possibilità ad esse garantite per evitare di pagare grandi somme di denaro in tasse, utilizzando mancanze di regolamentazione hanno suscitato un aumento di interesse nei

confronti di una disciplina a molti precedentemente sconosciuta quella del Transfer Pricing. L'OCSE stima che ogni anno vengano persi da 100 a 240 miliardi di dollari USA, a causa della pianificazione fiscale aggressiva, dell'interazione delle norme fiscali nazionali, della mancanza di trasparenza e del coordinamento tra le amministrazioni fiscali, limitate risorse per l'applicazione dei paesi e concorrenza fiscale dannosa. L'obiettivo finale è creare un quadro fiscale internazionale moderno, in base al quale i profitti siano tassati laddove si verifica l'attività economica e la creazione di valore. Alcuni dei punti di azione presentati dall'OCSE sono immediatamente applicabili, come le modifiche alle Linee guida sui prezzi di trasferimento. Mentre alcune altre azioni devono essere implementate nei trattati, come ad esempio gli strumenti multilaterali. L'OCSE e il G20 hanno concordato di collaborare al progetto BEPS almeno fino al 2020, per garantire che si possa effettuare un monitoraggio efficace delle misure concordate. Tutti questi buoni propositi tuttavia non hanno portato i benefici che ci si aspettava, lasciando gli stessi problemi precedenti all'attivazione del piano BEPS.

Il lavoro che andrete a leggere riguarda tali argomenti ed è articolato in cinque capitoli.

Partendo con il primo capitolo, di natura più descrittiva, vengono presentate ed analizzate precise e specifiche forme di regolamentazione del Transfer Pricing, vengono infatti presentati specifici riferimenti riguardo articoli dell'Organizzazione

per la cooperazione e lo sviluppo (OCSE) ed anche azioni riferite al progetto (BEPS) Base Erosion and Profit Shifting.

Proseguendo con il secondo Capitolo, viene presentata per la prima volta la tecnologia Blockchain alla base della nostra tesi, in maniera da poter descrivere e presentare precisamente i meccanismi dietro a questo sistema e come esso riesce dunque a funzionare.

Proseguendo ci troveremo di fronte al terzo capitolo, uno dei capitoli più incisivi ed importanti per comprendere i benefici che possono derivare dalla blockchain se ci riferiamo al campo delle transazioni infragruppo internazionali o Transfer pricing.

Nel quarto capitolo vengono presi in considerazione le problematiche alla quale la tecnologia Blockchain dovrà trovare soluzione nel campo legislativo, in questo senso le difficoltà che limitano la possibilità di regolamentare tale materia in maniera universale, verrà infatti posta l'attenzione su diversi paesi e su come essi intendono la regolamentazione del transfer pricing, in breve sarà anche presentato un caso studio pratico per spiegare in maniera pratica cosa comporta questa mancanza di cooperazione e regolamentazione.

Nel quinto ed ultimo capitolo invece verranno proposte diverse forme di Blockchain e si analizzerà quale di queste sia la migliore e debba essere adottata per poter regolamentare e gestire il fenomeno del Transfer Pricing, tenendo sempre conto dei limiti della tecnologia e degli attori che ne prenderanno parte.

Per concludere verranno presentate impressioni finali sul lavoro svolto e sulle prospettive che questa idea potrà avere.

## **ABSTRACT**

After the International Tax Week in which I participated in Baarlo, my interest in the phenomenon defined as Transfer Pricing has increased and has meant that my decision regarding the choice of my thesis fell on this topic.

The fundamental objective of this work is to analyze the contribution that the use of new technology such as the Blockchain can make in the field of regulation and management of Transfer Pricing and in international taxation regarding multinational companies.

The Blockchain is a technology that can be defined as new and emerging, proposes a new approach to database management, proposing the idea of a distributed ledger, in which data is stored on the servers participating in the chain and where the control is no longer provided by a well-defined central authority but is moved to all nodes in the network. The main features of this system have made the research very interesting as interesting is the possible application of this technology in the field of international taxation in this case more precisely in inter-group transactions.

Tax evasion by the large multinationals and the opportunities guaranteed to them to avoid paying large sums of money in taxes, using regulatory failures, has raised an interest in a discipline previously unknown to many that of transfer pricing. The OECD estimates that 100 to 240 billion US dollars are lost each year due to aggressive tax planning, the interaction of national tax laws, lack of transparency and coordination between tax administrations, limited resources for the application

of countries and harmful tax competition. The ultimate goal is to create a modern international fiscal framework, where profits are taxed where economic activity and value creation occur. Some of the action points presented by the OECD are immediately applicable, such as changes to the Transfer Pricing Guidelines. While some other actions must be implemented in the treaties, such as multilateral instruments. The OECD and the G20 have agreed to collaborate in the BEPS project at least until 2020, to ensure that effective monitoring of the agreed measures can be carried out. However, all these good intentions did not bring the expected benefits, leaving the same problems as before the BEPS plan was activated.

The work you are going to read concerns these topics and is divided into five chapters.

Starting with the first chapter, of a more descriptive nature, precise and specific forms of regulation of Transfer Pricing are presented and analyzed, in fact specific references are presented regarding articles of the Organization for Cooperation and Development (OECD) and also actions related to the project (BEPS) Base Erosion and Profit Shifting.

Continuing with the second chapter, the Blockchain technology is presented for the first time, in order to be able to describe and precisely present the mechanisms behind this system and how it can therefore function.

Continuing with the third chapter, you are going to see one of the most incisive and important chapters to understand the benefits that can derive from the blockchain if we refer to the field of international intragroup transactions or Transfer pricing.

In the fourth chapter the problems to which the Blockchain technology will have to find a solution in the legislative field are taken into consideration, in this sense the difficulties that limit the possibility of regulating this matter in a universal manner, will in fact be placed on the attention of different countries and how they mean the transfer pricing regulation, in short a practical case study will be presented to explain in a practical way what this lack of cooperation and regulation entails.

In the fifth and last chapter, different forms of Blockchain will be proposed and we will analyze which of these is the best and must be adopted in order to regulate and manage the phenomenon of Transfer Pricing, always bearing in mind the limits of technology and the actors who will take part in it.

To conclude, final impressions will be presented on the work done and on the prospects that this idea may have.

**CHAPTER 1:**  
**THE NEW GENERAL FRAMEWORK OF THE REGULATION**  
**OF THE DISCIPLINE OF THE TRANSFER PRICING**

**1.1 OECD REGULAMENTATION A SHORT OVERVIEW OF ART 9**  
**AND BEPS ACTIONS.**

In the last decade, we have seen tax authorities in charge of a profound reform regarding the control of international transactions, they have in fact become more innovative and vehement in parallel with the growth of the phenomenon of transfer pricing, precisely for this reason, the latter have aggressively focused on the emerging problems of transfer pricing, intellectual property and localization by multinational companies.

The need for increasing transparency has led to greater interest in the tax policies of the majority of companies concerning international transactions. Concurrently with this, the development of tax competition in Europe has raised concerns on the part of the European Commission regarding tax practices deemed harmful.

Regarding harmful tax practices, the Base Erosion and Profit Shifting (BEPS) project of the Organization for Economic Cooperation and Development (OECD) in 2015 played a key role in the management of such practices and was defined, "a

transformational wave [...] that crosses the community of global corporate taxpayers "1.

With the intention of avoiding, or at least complicating, basic erosion and the transfer of profits from multinational companies, the OECD has launched an action plan consisting of 15 actions concerning various fields of international taxation, with a special place for transfer pricing (TP). In short, "a transfer price is a price, used for accounting purposes, used to evaluate transactions between affiliated companies integrated under the same management at artificially high or low levels in order to make an unspecified income payment or transfer capital account among those companies "2.

Regarding this, the Organization for Economic Co-operation and Development (OECD) to try to complicate basic erosion and the transfer of profits by multinational companies, has started this plan, currently called BEPS, which consists of fifteen actions concerning the different areas of international taxation, with particular emphasis on transfer pricing regulations (TP).

In other words, the TP, is the practice of pricing, based on the principle of free competition Art.9 OECD, the set of transactions that take place between companies

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<sup>1</sup> EY (2016), How anti-BEPS policies are changing transfer pricing, 2016 EY Transfer Pricing Survey Series. Retrieved April 21, 2018, from [https://www.ey.com/Publication/vwLUAssets/EY-how-anti-beps-policies-are-changing-transfer-pricing-ie/\\$FILE/EY-how-anti-beps-policies-are-changing-transfer-pricing-ie.pdf](https://www.ey.com/Publication/vwLUAssets/EY-how-anti-beps-policies-are-changing-transfer-pricing-ie/$FILE/EY-how-anti-beps-policies-are-changing-transfer-pricing-ie.pdf)

<sup>2</sup> OECD Statistics Directorate. (n.d.). *OECD Glossary of Statistical Terms - Transfer price Definition*. Retrieved April 21, 2018, from <http://stats.oecd.org/glossary/detail.asp?ID=2757><http://stats.oecd.org/glossary/detail.asp?ID=2757>

that are however associated within a corporate group can be subsidiaries or branches.

The arm's length principle, also known as the fundamental sacral grail in the discipline of the TP, is reported below as stated in article 9 of the OECD tax convention model: "where conditions are imposed or imposed between the two companies in their relations commercial or financial that differ from those that would be realized between independent companies, so any profits that, due to these conditions, would have accrued in one of the companies, but, because of these conditions, they were not accumulated in this way, could be included in the profits of that company and taxed accordingly"<sup>3</sup>.

The free competition principle we are talking about makes it possible to treat members belonging to the same multinational (MNE), as if they were independent entities, in this way we are able to focus our attention on the nature of transactions between members. In this way, in fact, it is possible to re-adjust the profit when the conditions of the transactions do not match the conditions that would have been imposed in case of transaction between independent companies, in transactions and comparable circumstances. The analysis of controlled and uncontrolled

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<sup>3</sup> OECD (2017), OECD releases latest updates to the Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations. Retrieved April 21, 2018, from <http://www.oecd.org/tax/oecd-releases-latest-updates-to-the-transfer-pricing-guidelines-for-multinational-enterprises-and-tax-administrations.htm>

transactions, which takes the name of "comparability analysis", is fundamental in the application of the free competition principle analyzed here<sup>4</sup>.

Unfortunately, when analyzing this matter, we must also say that prices are not an exact science and in applying the principle of free competition there are several practical problems, for example the fact that the member companies can carry out operations that the independent companies would never undertake, or the great difficulty that tax administrations have in being able to obtain adequate information in order to apply the principle of free competition. From this we understand why intercompany transactions have been increasingly used for tax avoidance and the shift of profits by multinationals without finding any sanctions or losses. This created the basis for a counter-attack by the OECD, which was reflected in the implementation of the BEPS actions in 2015, a process that is still ongoing but which lacks the basic requirement of the obligation<sup>5</sup>.

Regarding our thesis focused on TP, the BEPS actions that should have the most impact on TP are actions 8-9-10 (concerning value creation) and action 13 (concerning price documentation transfer and reporting country by country).

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<sup>4</sup> OECD (2010), Review of Comparability and of Profit Method: Revision of Chapters I-III of the Transfer Pricing Guidelines, Centre for Tax Policy and Administration, pag. 6. Retrieved April 21, 2018, from <https://www.oecd.org/ctp/transfer-pricing/45763692.pdf>

<sup>5</sup> OECD. (2014). BEPS ACTIONS 8, 9 AND 10: DISCUSSION DRAFT ON REVISIONS TO CHAPTER I OF THE TRANSFER PRICING GUIDELINES. Paris: OECD PublishingPwC (2018). How Blockchain can help reduce Transfer Pricing complexity. Retrieved June 11, 2018, from <https://www.pwc.com/us/en/transfer-pricing/assets/pwc-how-blockchain-can-help-reduce-tp-complexity2.pdf>

As you can imagine, all this has established a substantial revision of the OECD guidelines, "the documents that provide indications on the application of the principle of free competition, which represents the international consensus on evaluation, for the purposes of income, transactions between associated companies"<sup>6</sup>. The 2017 edition concerning BEPS reflected a consolidation of changes concerning the (BEPS) and the transfer of profits without substantial new content.

In response to the objective of the following work, in the following paragraph more attention will be given to actions 8-10 and 13, describing how these actions have created new problems that must be faced by multinational companies.

## **1.2 THE ESSENTIAL FUNCTION OF INFORMATION IN THE BEPS**

With the aim of balancing the outcomes of the TP with the creation of value, actions 8,9 and 10 of the BEPS have required a strong clarification at the comprehensive and enforcement level, in the way in which the indications to be followed for the application of the arsenal principle and in extraordinary cases the possibility of using a special measure when the guidelines of the principle are not sufficient<sup>7</sup>.

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<sup>6</sup> OECD. (2014). BEPS ACTIONS 8, 9 AND 10: DISCUSSION DRAFT ON REVISIONS TO CHAPTER I OF THE TRANSFER PRICING GUIDELINES. Paris: OECD PublishingPwC (2018). How Blockchain can help reduce Transfer Pricing complexity. Retrieved June 11, 2018, from <https://www.pwc.com/us/en/transfer-pricing/assets/pwc-how-blockchain-can-help-reduce-tp-complexity2.pdf>

<sup>7</sup> OECD (2015), *Aligning Transfer Pricing Outcomes with Value Creation, Actions 8-10 - 2015 Final Reports, OECD/G20 Base Erosion and Profit Shifting Project*, OECD Publishing, Paris, pag. 9. Retrieved April 21, 2018, from <http://dx.doi.org/10.1787/9789264241244-en>

Starting with action 8 of the BEPS, it underlines the problem of transfer prices inherent in the so-called intangible assets and their correct allocation, with regard to this, further indications were provided by the OECD in 2015. With regard to intangible assets, the guide to which we refer establishes this: "legal ownership alone does not necessarily generate a right to all (or even none) of the return generated by the exploitation of the intangible"<sup>8</sup>.

However, what has become crucial is the contribution made by all the parts of the group to the activities they can be of development, protection, maintenance, improvement, exploitation. However, despite the multinational companies can still establish the roles of the participants, who play a role in all this in the case of transfers with intangible assets, through a contractual agreement. When these agreements conflict with the DEMPE rules, the transfer price to be implemented should be based on the last one.

Much importance is also given to the concept of risk related to the financing and development of intangible assets. The guideline distinguishes between the financial risk associated with the financing of a project and the risk associated with activities such as the development of a new intangible. When a specific party only provides financing without assuming any operational risk, the lender should only expect a

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<sup>8</sup> OECD (2017), OECD Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations 2017, OECD Publishing, Paris. Retrieved April 21, 2018, from [https://read.oecd-ilibrary.org/taxation/oecd-transfer-pricing-guidelines-for-multinational-enterprises-and-tax-administrations-2017\\_tpg-2017-en#page1](https://read.oecd-ilibrary.org/taxation/oecd-transfer-pricing-guidelines-for-multinational-enterprises-and-tax-administrations-2017_tpg-2017-en#page1)

return that reflects the risk in the event that the party exercises control and takes significant risks, will therefore be entitled to the associated profits and losses<sup>9</sup>.

The next step relates to the presentation of action 9 of the BEPS, this action takes into account the possibility that the allocation of risks and the activities actually carried out by the adhering parties, defined contractually with the consequent distribution of profits, does not follow the actual realization of the facts. The two actions in question are in fact linked to the concept of "risk" defined as: "the effect of uncertainty on the company's objectives"<sup>10</sup>. All projects that want to generate profit implicitly generate risks. In this way only the parties that exercise control over the risks will also appear to be part of their respective earnings.

To conclude, we present action 10 which focuses on profits from transactions that include the use of specific methods for determining transfer prices between subsidiaries in order to erode the tax base.

In conclusion, Multinational Enterprises must guarantee a clearer vision of how value is created within the organization and the contribution of each member. In fact, the structure of the company is more complex and branched out in terms of different markets and structurally, the more difficult it is to find the information

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<sup>9</sup> Henshall, J., Shapiro, A., & Reams, K. (2015), *Intangibles. The New Transfer Pricing Landscape A Practical Guide to the BEPS Changes*, Deloitte Development LLC, pages 17-21. Retrieved April 21, 2018, from <https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Tax/dttl-tax-new-transfer-pricing-landscape-practical-guide-to-beps-changes-secure.pdf>

<sup>10</sup> OECD (2015). *Aligning Transfer Pricing Outcomes with Value Creation, Actions 8-10 - 2015 Final Reports, OECD/G20 Base Erosion and Profit Shifting Project*, op. cit. pag. 10.

needed by the financial authority to perform the required analysis. The opinion shared by many scholars as well as that of those who are writing is that dealing with a complex subject like this using traditional methods is no longer possible, a stronger and more rigid regulation is required, accompanied by the latest generation methods of application.

### **1.3 THE BEPS ACTION REGARDING THE VALUE CREATION**

As is evident from the title, the BEPS action number 13 explicitly requires that companies be prepared to provide the tax authorities of each government in which they reside, documentation of past and present policy regarding the TP in a much more detailed manner and profound with respect to the past. Details of the company's global operations and taxation should also appear on this documentation to be drawn up<sup>11</sup>.

The previously mentioned action 13 presents a multi-level approach on transfer pricing documentation.

- **Master File**: it is a document that must be filled in by inserting all the global information concerning the multinational and once it is finished it must be made available to all the global authorities.

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<sup>11</sup> OECD (2010), Transfer Pricing Methods. Retrieved June 11, 2018, from <https://www.oecd.org/ctp/transfer-pricing/45765701.pdf>

- **Local File:** this document must have within it all the information regarding the company's corporate and inter-company transfers relevant to the group in all the countries in which it is present.

- **Country-by-Country:** this last document is a simple document showing the economic information of the group including income, earnings and taxes paid.

The new documentation required, requires more global transparency on the part of multinationals, this to help tax authorities discover possible deviations in TP policy. Multinational companies will need to ensure that the CbC report, master file and local files provide consistent and reliable information about their global and local operations and their transfer pricing policies.

However, the vast majority of companies will not be able to align most of the documentation with the BEPS principles, the type of information required by the country by country, in effect, involves skills outside transfer pricing, in a way that may not have happened before. New technological tools are now, beyond the past, necessary to keep up with the different compliance requirements, something that can no longer be tackled manually<sup>12</sup>.

However, a good part of the companies cannot align themselves with the documentation required by the BEPS principles, in fact they do not concern only

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<sup>12</sup> OECD (2017), OECD Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations 2017, OECD Publishing, Paris. Retrieved April 21, 2018, from [https://read.oecd-ilibrary.org/taxation/oecd-transfer-pricing-guidelines-for-multinational-enterprises-and-tax-administrations-2017\\_tpg-2017-en#page1](https://read.oecd-ilibrary.org/taxation/oecd-transfer-pricing-guidelines-for-multinational-enterprises-and-tax-administrations-2017_tpg-2017-en#page1)

the TP but require information that involves skills outside the simple TP, in a way never happened before. To keep up with the times and be able to respond to this demand for modernization and data management, the old technological tools are no longer suitable to keep up with the different compliance requirements, but new technological tools are needed.

In a world where not only business is transformed by new technologies, which have already started to be implemented, they can help multinational companies maintain high standards of compliance with the new rules mentioned and at the same time the tax authorities must become a strategic commercial partner in digital transformation.

## **CHAPTER 2:**

### **THE NEW FRONTIER OF TECHNOLOGY, THE BLOCKCHAIN**

In this chapter, a first analysis of this new and innovative Blockchain technology will be proposed, and furthermore the potential of this new technology will be presented, that is how it will be able to solve the problems related to the difficult regulation previously presented.

The problems related to the regulation of the Transfer Pricing phenomenon, as you will have noticed, are also dictated by the fact that all the actions and laws previously presented are not binding for the member states but there is only a guideline on how to deal with the issue of Transfer Pricing.

Following the analysis, it will be proposed an analyzes on the decentralization of decisions, then a short focus on the problem defined as Byzantine generals (as regards the indispensable trust in this system), the thesis continue on to a brief analysis on the modality and consequentiality of the actions that take place in a managed transaction through Blockchain technology, the chapter will conclude with a brief analysis regarding the risk management in case of "fork".

#### **2.1 BLOCKCHAIN A NEW GLOBAL ORDER**

When we hear about Blockchain, we talk about one of the most advanced technologies discussed in the global scene, obviously in the business field we have

seen alongside the bitcoin world explosion, it has been defined as one of the most important trends. Many different applications have been created and developed on the basis of this technology and proposals to banks, companies and even governments. However, the more uproar it triggers, the more obscure it appears. To try to understand, therefore, once and for all how it works, you have to take a step back and start from scratch.

The birth of the Blockchain started in 2008<sup>13</sup>, when a breaking paper was published for the first time, written by the unknown and mysterious figure of Satoshi Nakamoto. The publication described one of the possible applications of the technology, in that case a cryptocurrency, the Bitcoin. It is essential to explain that Bitcoin and Blockchain technology are not the same thing. Bitcoin is nothing more than one of the possible applications of this technology, which turns out to be one of the most powerful and disruptive technologies of the century, but which remains a mysterious object for many, and while the life of Bitcoin after having touched the apex of living fame its future between skepticism, the same cannot be said about the Blockchain.

However, the Blockchain should not be seen only as a technological solution, but think of it as a new concept based on trust. It proposes a completely opposite view with respect to the past conception of control, in which a central and certified

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<sup>13</sup> Panetta, K. (2017, October 13). *Gartner's Top 10 Strategic Technology Trends for 2017*. Retrieved April 21, 2018 from <https://www.gartner.com/smarterwithgartner/gartners-top-10-technology-trends-2017/>

authority authorizes operations and transactions. With the Blockchain, all this no longer belongs to a center, but everything is completely decentralized to all the participants in the chain with the role of nodes. The autonomous and certified center is no longer necessary. All this entails a new concept of trust in which it is possible to create a global system of relations based on the concepts of absolute transparency and immutability. As mentioned earlier, trust is the key word in Blockchain technology. As demonstrated by the Bitcoin-Blockchain, it is clear that it is no longer necessary to have a central body, such as a bank for example to manage transactions of a currency (in this case cryptographic), but the system regulates itself<sup>14</sup>. The fundamental point of Satoshi Nakamoto's work is just this, for example in a commercial relationship between two entities that do not know each other, there will no longer be a need for a third party to guarantee the two subjects, the transaction will be regulated and verified by the majority of participants in the chain.

Because of the difficult understanding of this technology, we are dealing with a mysterious object with many different definitions. The most used is the one that defines the Blockchain as a distributed ledger, different from the traditional centralized register represented in Figure 1, in different ways. An old-fashioned

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<sup>14</sup> Xu, X., Weber, I., Staples, M., Zhu, L., Bosch, J., Bass, L., Pautasso, C., Rimba, P. (2017). A Taxonomy of Blockchain-Based Systems for Architecture Design, 2017 IEEE International Conference on Software Architecture (ICSA). Retrieved June 11, 2018 from doi:10.1109/icsa.2017.33

ledger is the one that has been used until now by banks and governments to track transactions and goods ownership. Then there is a central authority as previously mentioned that updates the register in order to identify who owns the goods and whether the new transactions have met the criteria of legality or not. The trust that people have towards this central authority allows the development of transactions between individuals never met before.

The centralized logic is represented by the “traditional” Centralized Ledger with a strictly centralized One-To-Many relationship, where everything must be managed by referring to a centralized structure, authority or system.

In Centralized Ledger, trust is in authority of the subject or system that represents the "Center" of the organization.

The Decentralized Ledger re-proposes the logic of centralization at the "local" level with "satellites" organized in turn in the form of One-To-So many that relate in turn to a form that repeats the One-To-Many model. There is no longer a "big" Central subject but many "central subjects". The trust in this case is also delegated to a central subject, logically closer, but still centralized<sup>15</sup>.

Organizations based on the Decentralized Ledger define a Governance that establishes forms of centralized coordination.

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<sup>15</sup> Bellini, M. (2018, July 02). *Blockchain: Cos'è e come funziona veramente, una guida per capire*. Retrieved June 21, 2018, from <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

The real change is represented by the Distributed Ledger, that is from a real and complete distributed logic where no center exists and where the logic of governance is built around a new concept of trust among all the subjects. Nobody (but really nobody) has the opportunity to prevail and the decision-making process passes strictly through a Consensus building process.<sup>16</sup>

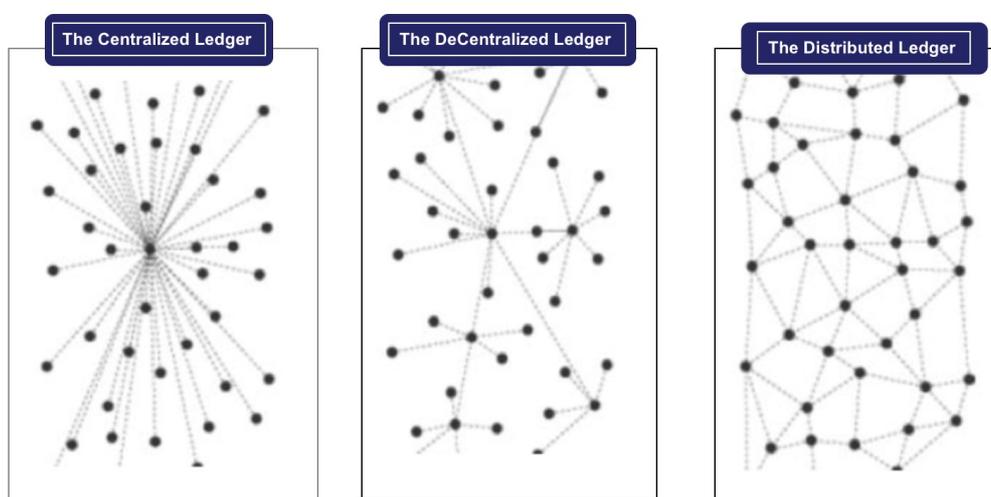


FIG 1 Source: Bellini, M. (2018 - April 11) Blockchain: cos'è, come funziona e gli ambiti applicativi in Italia, from <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

The term Ledger refers to a database that is not controlled and managed by a single server, but is distributed and synchronized on all the devices connected to the network, the so-called nodes.

Transaction data is stored on all computers so that they cannot be changed retroactively. All participants have free access to these data with possibility to

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<sup>16</sup> Amato, M., Fantacci, L.,(2018) *Per un pugno di bitcoin: Rischi e opportunità delle monete virtuali.*

change or modify them only if it will be accepted by all the participants who agree on its legitimacy<sup>17</sup>.

The blockchain is a technology that allows the creation and management of a large distributed database for the management of transactions that can be shared between multiple nodes of a network. This is a database structured in Blocks (containing multiple transactions) that are connected to each other in a network so that every transaction initiated on the network must be validated by the network itself in the "analysis" of each individual block<sup>18</sup>. The blockchain is thus made up of a chain of blocks that contain multiple transactions each. The solution for all transactions is entrusted to the Nodes that are called to see, control and approve all transactions by creating a network that shares on each node the archive of the whole blockchain and therefore of all the blocks with all transactions. Each block is also an archive for all transactions and for the entire history of each transaction, which can only be changed with the approval of the network nodes. Transactions can be considered unmodifiable (except through the repetition and the "re" -authorization of the same by the entire network). Hence the concept of immutability.

Analyzing the Blockchain we can understand that such a profitable system has only appeared now because of the lack of the indispensable technology for its birth.

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<sup>17</sup> Bellini, M. (2018, July 02). *Blockchain: Cos'è e come funziona veramente, una guida per capire*, op.cit.

<sup>18</sup> Bellini, M. (2018, July 02). *Blockchain: Cos'è e come funziona veramente, una guida per capire*. Retrieved June 21, 2018, from: <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

In the Blockchain, every operation performed must be automatically confirmed by all the nodes using cryptographic software. In this way, customers who participate in the network confirm that each unit of value (cryptocurrency, assets, services) has been transferred only once and with the use of a public-private key, they verify the identity of the operators (which remains anonymous) and the legitimacy of the transaction. In this way, the exchange of values based on Blockchain can be completed in an extremely quicker, safer and cheaper way than traditional systems<sup>19</sup>.

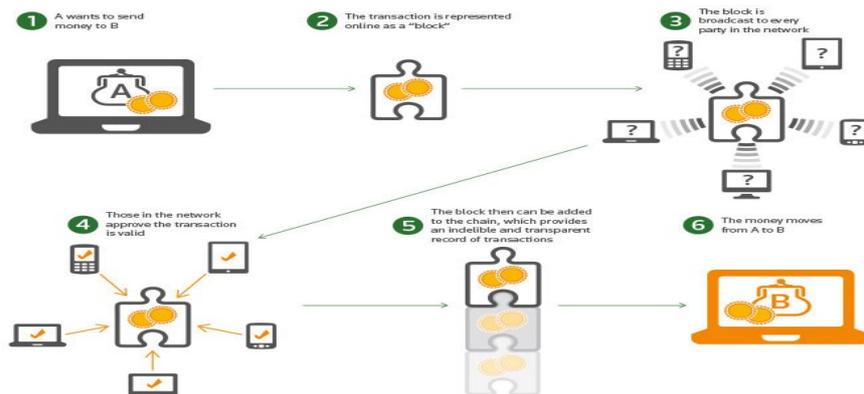


FIG 2 Bellini, M. (2018 - April 11) *Blockchain: cos'è, come funziona e gli ambiti applicativi in Italia*, from <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

We can therefore go on to define what are the basic components of the Blockchain<sup>20</sup>:

<sup>19</sup> Bellini, M. (2018, July 02). *Blockchain: Cos'è e come funziona veramente, una guida per capire*. Retrieved June 21, 2018, from: <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

<sup>20</sup> Bellini, M. (2018, July 02). *Blockchain: Cos'è e come funziona veramente, una guida per capire*. Retrieved June 21, 2018, from: <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

- Node: are the participants in the blockchain.
- Transaction: it consists of data that represent the values object of "exchange" and that need to be verified, approved and then archived.
- Block: is represented by the grouping of a set of transactions that are combined to be verified, approved and then archived by the blockchain participants.
- Ledger: it is the public register in which all transactions carried out in an orderly and sequential manner are "noted" with maximum transparency and in an unchanging way. The Ledger consists of the set of blocks that are chained together by an encryption function and thanks to the use of hashes.
- Hash: it is an operation (Non-Invertible) that allows to map a string of text and / or numeric of variable length in a single and univocal string of determined length. The Hash uniquely and securely identifies each block. A hash must not allow to go back to the text that generated it.
- Digital signature: Allows authentication of digital material.
- Time Stamp: consists of a specific sequence of characters that uniquely and indifferently associates a legally valid date and time to a specific one. This allows us to perfectly test the stoic of each event.
- Consensus mechanism: fundamental mechanism of the Blockchain with which all the participants agree on the present state of the ledger. There are several types.

In the next sections, we will try to give a more detailed explanation to the digital signature, to the Hashing and to conclude with the consent mechanism. These are the most important mechanisms behind the Blockchain technology but also the most complex ones to analyze in their relationship with the Blockchain.

## **2.2 AUTENTICATION AND CORRECTNESS OF TRANSACTION (DIGITAL SIGNATURE AND HASHING)**

These two technologies we are talking about are essential for the operation of a decentralized system, as it is able to allow authentication of the transactions carried out on the network.

The digital signature<sup>21</sup> is a combination of the details of a transaction and a specific private key, thanks to this you can publish any document without having to worry about the danger of counterfeiting. This method ensures a cryptographic identity without having to reveal its identity, thus presenting itself to other nodes.

If a transaction is blocked by using a public key, only the next private key can unblock it, but the latter is different for each transaction so that it cannot be used outside of that transaction<sup>22</sup>.

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<sup>21</sup> Nakamoto, S. (2008, November). *Bitcoin: A Peer-to-Peer Electronic Cash System*, op. cit. pag. 3.

<sup>22</sup> Croman, K., Decker, C., Eyal, I., Gencer, A. E., Juels, A., Kosba, A., ... & Song, D. (2016). On Scaling Decentralized Blockchains. In *International Conference on Financial Cryptography and Data Security* (pp. 106-125), Christ Church, February 22-26, 2016. Berlin: Springer.

However, the message is still editable before arriving at the recipient, to prevent it from being counterfeited, the recipient can postpone the message for a compliance check. This is only possible if the message is not too heavy. In this case, hashing comes into play, a fast control system that transforms data of variable dimensions into fixed dimensions.

The example we will make is simple to understand and widely used in several books<sup>23</sup>, we consider that the message we want to hash is "Blockchain", the procedure is to associate each letter with a progressive number:

$$A = 1; B = 2; C = 3; D = 4; E = 5; \dots \infty$$

We can see how each letter is associated with a number, multiplying the letters that make up the message among them, in this case "Blockchain", the final result will be:

$$2 \times 12 \times 15 \times 3 \times 11 \times 3 \times 8 \times 1 \times 9 \times 14 = \mathbf{35925120}$$

Once the message is sent together with the hash, the recipient can easily compare the message with the hash received and confirm the correctness of the message. The hash and the algorithm that is at its base must have specific characteristics: The functions of the hash cannot be reversed, the original message cannot be reconstructed from its hash value; For each input value, it must always generate the

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<sup>23</sup> Amato, M., Fantacci, L., (2018) *Per un pugno di bitcoin: Rischi e opportunità delle monete virtuali*.

same hash value; It must be impossible to find an input that gives the same hash output as another input<sup>24</sup>.

To better understand these dynamics, and the concepts introduced and how they relate to the Blockchain, we will provide an example.

Students waiting in the same room decide to make transactions using a virtual currency, so it is essential to find a mechanism to track the amount of currency that is in the possession of each student, so as to update the information keeping within the system only the correct information.

As mentioned previously, there are two possibilities<sup>25</sup>: the first is to appoint a central authority that keeps everything under control and that has the reliability necessary to operate. The second is to decentralize operations. Each student must write their transactions in a block. They must exchange not only the information regarding the transaction they are carrying out, but also all the transactions carried out up to now. When each student fills the page of the block (considering that all individuals have the same information) we calculate the hash of the previous page, we perform this operation, we mix the information on the page, we write at the top of the new page and we sign it, then the page is subsequently distributed to the other participants.

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<sup>24</sup> Amato, M., Fantacci, L. (2018) *Per un pugno di bitcoin: Rischi e opportunità delle monete virtuali.*, op. cit

<sup>25</sup> Malanov, A. (n.d.). *Come funzionano i Bitcoin e la tecnologia blockchain: Manuale di base*, op. cit.

The signature as said is the proof of the conformist of the message, while the hash gives a summary of the previous information and is proof of originality. All participants can verify the hash in their possession with that of the eggs page, this ensures that all have registered the same transactions. After this first check, all students should have the amount of virtual currency they had decided to exchange. If this additional check is satisfied, each player sees a new block page added. However, here arises one of the fundamental problems of blockchain, who prevents a participant from starting a contemporary page and thus have different versions of the register circulating at the same time? One method of obtaining consent in a distributed ledger is the so-called proof of work, a mechanism developed by Satoshi Nakamoto for Bitcoin. In the next section the problem of consent will be analyzed.

### **2.3 THE BLOCKCHAIN DIFFICULTS: BYZANTINE GENERAL PROBLEM AND CONSENSUS PROBLEM**

If we focus on the concept of trust and on how to obtain consensus in a system not connected to a central system, which as we have seen is the keystone of blockchain technology, we can see how the "problem of the Byzantine general"<sup>26</sup> develops.

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<sup>26</sup> Lamport, L., Shostak, R., Pease, M. (1982). The Byzantine Generals Problem. ACM Transactions on Programming Languages and Systems, 4(3), 382-401 doi:10.1145/357172.357176

It is nothing more than a riddle based on the need of a Byzantine general<sup>27</sup>, during a siege, to send, through messengers, the order to attack the enemy to other lieutenants who are in different places. The army has many divisions and every division has a general. Only if the strategy is attended by all the generals, the action will succeed otherwise everything will end with an inevitable defeat.

The problem is that everyone knows that one or more traitors are among them. They are presumed to be a minority, so they can not directly hinder the outcome of the strategy, but indirectly they can spread the wrong message and confuse the loyal generals, reaching their purpose<sup>28</sup>.

How can we guarantee loyal generals that everyone is in a position to have the correct order and follow the common strategy? Until now the solution was a trusted third party whose authority was recognized by everyone and to whom everyone could turn to verify the reliability of the information received. But of course, this is not possible in the case of the problem of the Byzantine general because this possible third authoritative part could not be reached by all generals.

There are several solutions, that of Lamport, Shostak & Pease (1982) turns out to be the most interesting, they have presented an algorithm that allows to reach a consensus if "for every  $m$ , [...] there are more than  $3m + 1$  general and at most  $m$

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<sup>27</sup> Castro, M., & Liskov, B. (1999), Practical Byzantine Fault Tolerance, Proceedings of the Third Symposium on Operating Systems Design and Implementation. Retrieved June 11, 2018, from <http://pmg.csail.mit.edu/papers/osdi99.pdf>

<sup>28</sup> Amato, M., Fantacci, L. (2018) *Per un pugno di bitcoin: Rischi e opportunità delle monete virtuali.*, op. cit

traitors "<sup>29</sup>, an algorithm works then, if the number of traitors is less than 1/3 of all generals.

The way the algorithm works is very straightforward and can be easily explained by looking at Figure 3, where the solution for the situation of four generals is provided. One of them is the role of commander and is in charge of deciding the strategy, and the other three are lieutenants. The commander sends the message to all the lieutenants, but one of these four generals is a traitor and will try to confuse the other generals. We can have two situations, one in which the traitor is the commander, and one in which the traitor is one of the lieutenants.

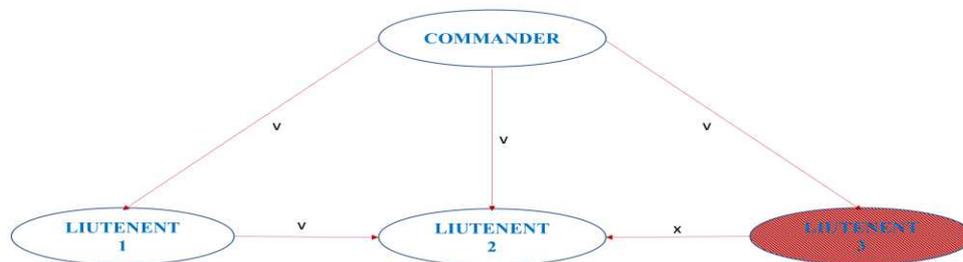


FIG 3 Lamport, L., Shostak, R., Pease, M. (1982). *The Byzantine Generals Problem*, op. cit. pag. 388. Rielaboration

Suppose that now Lieutenant Number 3 is the traitor and that the strategy decided by the commander is equal for everyone. Being fair, the commander will distribute the correct strategy to all the lieutenants, the problem is that the lieutenants do not

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<sup>29</sup> Lamport, L., Shostak, R., Pease, M. (1982). *The Byzantine Generals Problem*, op. cit. pag. 388.

know if they can trust the commander. The answer to the problem is that all the lieutenants have to do again what the commander did first with them and send the message they received to the other players. In the example, Lt. 1 and 2 will transmit to all the others the message they received, strategy v. The traitor will spread an erroneous strategy, different from that received by the commander, strategy x. To avoid confusion, every lieutenant should collect the total message he has received and act by majority. Lieutenant 1 received, strategy v from the commander, strategy v from lieutenant 2 and strategy x from lieutenant 3. Act on the majority of results in the choice of strategy, the same thing for lieutenant 2. So, loyal generals will be able to find a consensus and action.

The situation in Fig.4 is different, in which the traitor is the commander.

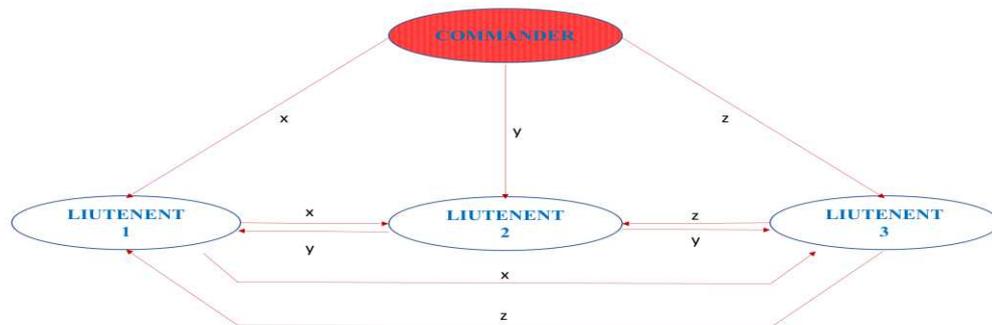


FIG 4 Lamport, L., Shostak, R., Pease, M. (1982). *The Byzantine Generals Problem*, op. cit. pag. 388. Rielaboration

The situation is now more difficult, because if the messages disseminated by the commander are all different, in this case strategy x y z, using the same process used previously, the lieutenants will not find a majority strategy to follow. For example,

lieutenant 1 will receive  $x$  from the commander,  $y$  from lieutenant 2 and  $z$  from lieutenant 3. In this case a new rule should be added, for example "choose strategy  $y$ " in case the majority cannot be reached. Also in this case the faithful will act according to a common strategy.

Satoshi Nakamoto, however, provided a further method to solve the problem of consensus regarding bitcoins, in this case it is based on the concept of timestamp and proof of work.

Following the history of the Byzantine Empire, but in this case every general takes 15 minutes to draft a message and communicate it to the next general, including all the previous messages received to build a chain. All messages have a strategy within them and to make the chronology of work visible, they must also report the data with which they have been prepared. So, we find ourselves in a situation where the command sends a message to Lieutenant 1 with a strategy to follow, which we call  $v$ , and the message arrives in 15 minutes. Subsequently, Lieutenant 1 sends a message to Lieutenant 2 (the traitor) in 15 minutes. The traitor then receives the correct strategies  $v$ . Lieutenant 2 (traitor) sends a message to Lieutenant 3 with incorrect content that is different from the others. The problem that arises for the traitor is that, to make everything realistic for Lieutenant 3, it should also change the messages of Commander 1 and Lieutenant 1 and Lieutenant 2. Assuming that preparing each message takes 15 minutes, preparing together three of them will take

45 minutes, which is 30 minutes longer than normal time. At this point Lieutenant 3 faces a double scenario:

1. Lieutenant 3 receives three messages of which the last one has a different content than the others. Lieutenant 3 will find out that Lieutenant Two is the corrupt and will trust most of the information received.
2. The messages are synchronized with each other but arrive with a 30-minute delay compared to normal and so it is clear that Lieutenant 2 is the traitor.

Following this idea, the only modality that Lieutenant 2 has in his possession in order to achieve his goals is to prepare all the messages in 15 minutes, which is not possible. A different and complicated situation could be the situation in which the majority of participants / generals is corrupt and the most numerous chain of messages is the wrong one.

The way it is used in reality to create a situation where a certain amount of time is needed to prepare a block of transactions is the Labor Proof<sup>30</sup>, a distributed consensus mechanism based on a very complex mathematical problem to be solved. The solution, which is unique, consists in finding a cryptographic hash function. In short it means to guess random numbers that combined with the hash of the previous block generate a defined result. Each participant node uses special software and hardware to solve the problem. This activity is particularly intense in terms of

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<sup>30</sup> BitFury Group (2015). Proof of Stake versus Proof of Work: White Paper. Unpublished manuscript. Retrieved online on the 29th of October 2017 from <http://bitfury.com/content/5-white-papers-research/pos-vs-pow-1.0.2.pdf>.

computing power is very expensive, for this reason, in order to create incentives to extract more blocks, a prize is awarded to anyone who solves the enigma before the other. This operation is defined as "Mining" and is carried out by the "Miner".

The work of the "Miner" is absolutely fundamental in the economy of blockchain management. Anyone can become a "Miner" and can compete to be the first to solve the complex mathematical problem linked to the creation of each new block of transactions in a valid and encrypted way that can be added to the blockchain. For example, cryptocurrency, in addition to this, the first to find the hash can write the new block collecting all the transactions. In this way only one version (or chain) will be present in the system. The main reason for this complexity is to prevent participants from falsifying all the block pages up to the most recent one and presenting their version of the chain.

In the next section, we could finally explain how transactions actually take place on the Blockchain network.

## **2.4 BLOCKCHAIN STEP BY STEP**

In a simple way, we see the steps that define the operation of a simple transaction based on the blockchain.

We can summarize the procedure as the sum of several steps<sup>31</sup>:

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<sup>31</sup> Bellini, M. (2018, July 02). *Blockchain: Cos'è e come funziona veramente, una guida per capire*. op. cit.

- 1- In a transaction on Blockchain regardless of what is negotiated, to start the process on the Blockchain network are necessary some elements, such as the price of the goods exchanged, the information on the property, the economic availability of the buyer and any other information necessary to complete the frame of reference.
- 2- The transaction then begins with the creation of the digital signature and the public key of each participant.
- 3- Each time a transaction is recorded it is grouped with other new transactions in a block. Each block contains the records of all recent transactions and a reference to the block pretend (Hash)<sup>32</sup>.
- 4- Each node then transmits transactions to a network in a block, but only one will be accepted by the network. Each participant will have to solve the mathematical problem we have previously analyzed in the manner previously analyzed. The successful miner announces the new block to the rest of the network and the network checks the validity. Users accept a new block only when it has been verified that all of its transactions are valid and transactions are accepted only if most users agree that it is correct. All this process is automated: the system checks if the request comes from the authorized node and performs a sort of "verification". Since all the blocks

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<sup>32</sup> D'Aliessi, M. (2016, June 01). *How Does the Blockchain Work?* – Michele D'Aliessi – Medium, op. cit.

are timestamped and sorted chronologically, the system checks all the transactions passed in the chain up to the first block looking for errors or discrepancies: for example, that the seller has not already sold the asset and the buyer has not already spent the money. Of course, you can have something (money, house, bitcoin) in the amount you're claiming, only if you can show the previous incoming streams in your account whose total balance is equal to or greater than the value of what you're trading. In this way, the double expense problem is avoided<sup>33</sup>.

- 5- If the check shows no discrepancy, the block is permanently chained, so that, once the transaction is included in the block and block in the blockchain, there is no possibility of modifying or deleting it. Moreover, there cannot be a false version of the Blockchain because all users have their own version to be opposed. Secondly, any attempt to modify it is recorded in the blockchain and immediately transmitted to everyone. Blockchain is therefore a transparent registration of reality<sup>34</sup>.

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<sup>33</sup> D'Aliessi, M. (2016, June 01). *How Does the Blockchain Work? – Michele D'Aliessi – Medium*, op. cit.

<sup>34</sup> Bellini, M. (2018, July 02). *Blockchain: Cos'è e come funziona veramente, una guida per capire*. op. cit.



## 2.5 THE PROBLEM OF THE FORK

It is possible that two nodes can find the solution to the problem and spread the solution at the same time. This event is called: "fork"<sup>35</sup>. Fig 6.

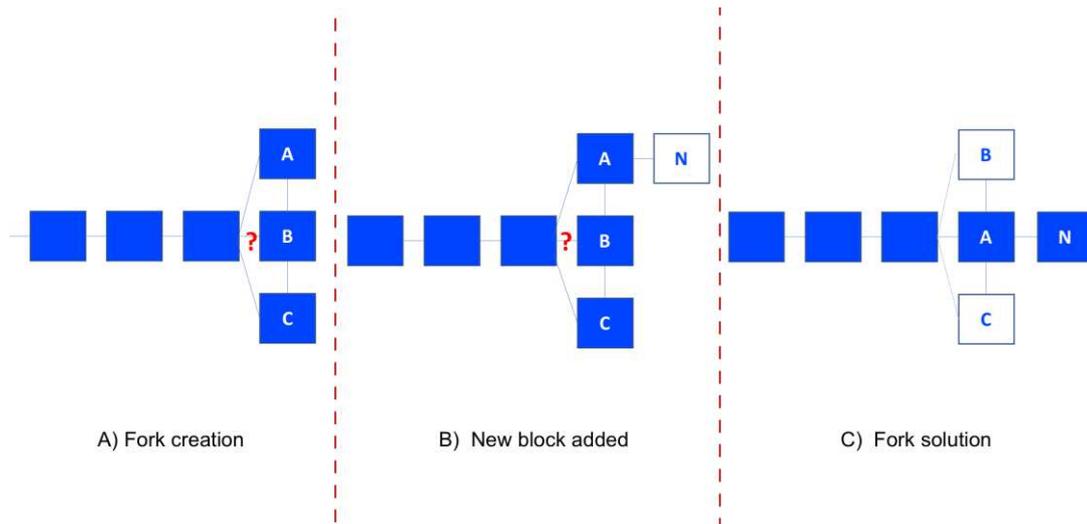


FIG 6 D'Aliessi, M. (2016, June 01). *How Does the Blockchain Work?* – Michele D'Aliessi – Medium, op. cit.

The system manages to rebalance itself by preferring the longest chain, as soon as a block is added to the previous ones, fig 6, this will become the longest chain and all the participants will work to resolve this ambiguity. The nodes prefer a longer chain for a simple reason, we imagine that some false information want to be inserted in the system, the node in question will not only solve the mathematical problem to enter their information but will rewrite the entire chain Blockchain. The system will understand these discrepancies and the block will be rejected. The only possible solution as previously mentioned with regard to the Byzantine problem

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<sup>35</sup> Chakravarty, A. (2016, December 23). *The Product Manager's guide to the Blockchain - Part 1*, Op. cit.

will be to rewrite the entire block and solve all the following mathematical problems.

However, this is almost impossible, as following the previous example in which we stated that the participant needed 15 minutes for each block, the falsifier will have to solve all the blocks in this time frame and the more blocks there are, this will be difficult. Citing the words of the founder Nakamoto (2008): "the race between honest chain and chain of attackers can be characterized as a random binomial walk in which"<sup>36</sup>:

p = probability that an honest node will detect the new solution

q = probability that the falsifier will detect the new solution

The two probabilities represent the computational power, the greater it is and the greater the chances of finding the right solution. The likelihood of an attacker recovering from a given z-blocking deficit already attached to the chain is analogous to the Gambler's Ruin problem<sup>37</sup>, and the likelihood that the forger builds a chain that will reach the honest chain is equal to:

$$q_z = \begin{cases} 1 & \text{if } p \leq q \\ (q/p)^z & \text{if } p > q \end{cases}$$

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<sup>36</sup> Bellini, M. (2018, July 02). *Blockchain: Cos'è e come funziona veramente, una guida per capire*. op. cit.

<sup>37</sup> Nakamoto, S. (2008, November). *Bitcoin: A Peer-to-Peer Electronic Cash System*, op. cit. pag. 6.

If the falsifier has less computational power than the loyal ones then  $p > q$ , otherwise  $p < q$ . In the first case the possibility of the falsifier to reach the final block is exponential because the number  $z$  of blocks increases.

"In a peer-to-peer network with proof of work, it becomes computationally impossible for a fake user to change data, if the honest nodes are in the majority in the CPU".<sup>38</sup>

This emphasizes why the longer chains are the preferred ones. All the participants know about it, which is why nobody wants to spend energy in a smaller chain that will be rejected<sup>39</sup>.

The way to defraud the system is substantially one, obtaining 51% of the computational power by the attacker. (corrupting other nodes). Corrupting 51% of individuals can add new pages or blocks that may contain false information. But in this case the Blockchain will collapse because the remaining 49% of the nodes will leave the system.

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<sup>38</sup> Nakamoto, S. (2008, November). Bitcoin: A Peer-to-Peer Electronic Cash System, op. cit. pag. 8.

<sup>39</sup> Amato, M., Fantacci, L.,(2018) Per un pugno di bitcoin: Rischi e opportunità delle monete virtuali.

## **CHAPTER 3:**

# **THE BIG SHORT: TRANSFER PRICING AND BLOCKCHAIN**

If in the previous chapters some hints were introduced regarding the legal regulation of transfer prices and subsequently an initial analysis of the Blockchain technology was provided in all its procedures.

In this chapter, we are cautiously preparing to relate the Blockchain with the discipline transfer pricing, through a theoretical and empirical analysis.

### **3.1 TRANSFER PRICING: MISSING EXPECTATIONS AND TRUST?**

Intragroup transfers are very important for multinational companies. The trust that exists between companies, which also operate in different jurisdictions and countries but belonging to the same company, is able to reduce transaction costs in a consistent manner if compared with those that occur between independent parties. Considering that MNEs have control of over 50% of all global trade, it is easy to understand why the phenomenon of transfer pricing is one of the most debated problems nowadays<sup>40</sup>.

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<sup>40</sup> PwC (2018). *How Blockchain can help reduce Transfer Pricing complexity*, pag. 1. Retrieved June 11, 2018, from <https://www.pwc.com/us/en/transfer-pricing/assets/pwc-how-blockchain-can-help-reduce-tp-complexity2.pdf>

The problem behind this phenomenon lies in the fact that the prices set by the companies associated with the same multinational, could try to abuse of this legal practice to shift the taxable profits where it is more convenient and circumvent the international taxation<sup>41</sup>.

The clear sign of the lack of trust between governments that do not trust transactions between related parties and the MNS, which hardly discloses their sensitive data, is the existence of anti-tax avoidance rules in the various countries legislations. In this sense, the OECD and the BEPS<sup>42</sup> have provided a guideline which, however, as we will see in the following chapters, will not be sufficient to have a universal regulation of this discipline at legislative level. Transfer pricing regulation has proved incredibly complex and the requirements for its effective implementation are staggering considering the numerous legal burdens that multinational companies have to face successfully to avoid sanctions. At this point the most interesting contribution of Blockchain technology will be presented in reducing the various complexities we have discussed. The Blockchain will not replace the international principles but will propose a new and reliable way to adjust some limits that have emerged, such as the arm length principle, where there is no clear

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<sup>41</sup> Sim, T., Owens, J., Petruzzi, R., Tavares, R. J., Migai, C. (2017), *Blockchain, Transfer Pricing, Custom Valuations and Indirect Taxes: The Potential of the "Trust Protocol" to Transform the Global Tax Environment*, Blockchain: Taxation and Regulatory Challenges and Opportunities, WU Global Tax Policy Centre. Pages 2-4. Retrieved June 11, 2018, from <https://www.eventleaf.com/Attendee/Attendee/ViewExhibitorDocument?eId=3PiaJfTLiwOlvrBoRXLDRg%3D%3D&edId=sFZYKuSrGvTyT9XyX81ikg%3D%3D>

<sup>42</sup> EY (2016), How anti-BEPS policies are changing transfer pricing, 2016 EY Transfer Pricing Survey Series. Retrieved April 21, 2018, from [https://www.ey.com/Publication/vwLUAssets/EY-how-anti-beeps-policies-are-changing-transfer-pricing-ie/\\$FILE/EY-how-anti-beeps-policies-are-changing-transfer-pricing-ie.pdf](https://www.ey.com/Publication/vwLUAssets/EY-how-anti-beeps-policies-are-changing-transfer-pricing-ie/$FILE/EY-how-anti-beeps-policies-are-changing-transfer-pricing-ie.pdf)

guideline and that has caused different interpretations from one legislation to another. Blockchain will be able to offset these numerous problems by building a community of tax authorities and taxpayers based on trust and reputation.

### **3.2 BLOCKCHAIN AND ITS ANALYSIS: ADEQUATE, PRACTICAL AND RATIONAL.**

Information asymmetry within a multinational can take two forms<sup>43</sup>:

1. The asymmetry between entities within the multinational, which exists when "affiliated entities often maintain their accounting books, inventory and methods for determining intercompany prices".
2. The asymmetry between tax administration and the multinational.

Thanks to the BEPS actions discussed above, from 8 to 10, it is possible to give a strong importance to the functional analysis whose objective is to find a clear vision of the role and contributions of each party in the transaction to the creation of value. (Example: intangibles)

There are many approaches to functional analysis, but the most famous and those that we will treat are the formula VCA and the empirical VCA:

- **FORMULA VCA** is based on the analysis of key factors of value and finally uses this information to divide the overall profit among the various entities.

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<sup>43</sup> Sim, T., Owens, J., Petruzzi, R., Tavares, R. J., Migai, C. (2017), *Blockchain, Transfer Pricing, Custom Valuations and Indirect Taxes: The Potential of the "Trust Protocol" to Transform the Global Tax Environment*, op. cit. pag 6.

- **EMPIRICAL VCA**, on the other hand, is based on the use of information found through the Arm's length principle, the use of classical tools to determine the TP and further information provided by the companies<sup>44</sup>.

For both methods, the level of coordination and organization of the amount of information required is very high precisely for this reason the Blockchain can help in several ways:

1. Blockchain could be used to unify all processes with which transactions are recorded, thus obtaining transparency, immutability of information and the possibility for all companies belonging to the MNE group to access data<sup>45</sup>.

2. The transparency achieved, will allow the multinational company to understand how the value is created, thus being able to demonstrate where a transaction between parties originated, when it occurred and the terms with which it occurred. In this way, the availability of reliable data manages to conduct an efficient functional analysis and helps the fiscal function, providing it with a complete and valid source of data that includes a chronological data of each resource and the price conditions along the transaction<sup>46</sup>.

3. The previously mentioned transparency and immutability play a fundamental role when we talk about the problem of intangibles. This point is fundamental given

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<sup>44</sup> Furtun, E., Burgess, J., Cooper, A., Kammerer, H. (n.d.). *Rethinking value chain analysis*. Transfer Pricing Perspectives: The New Normal: Full TransParency, pag. 12. Retrieved June 11, 2018, from <https://www.pwc.com/gx/en/tax/publications/transfer-pricing/perspectives/assets/tp-16-value-chain-analysis.pdf>

<sup>45</sup> PwC (2018). *How Blockchain can help reduce Transfer Pricing complexity*, op. cit.

<sup>46</sup> PwC (2018). *How Blockchain can help reduce Transfer Pricing complexity*, op. cit.

the change in the intangibles discipline introduced by the BEPS, in particular the DEMPE analysis (development, improvement, maintenance, protection, exploitation). Before the introduction of DEMPE the owner of the asset considered intangible had the right to obtain all the profits generated by the exploitation of the asset, in this way the MNEs were entitled to move their registered office of these assets in a country with very low taxation, reducing their tax liability, such as Google, Apple or Starbucks. The legal ownership is not sufficient, but the yields of the asset should be divided according to the contribution paid by each member of the group to the development of the asset. In this case, the Blockchain will be able to demonstrate the contribution of each member of the group to the development and exploitation of intangible assets and intellectual property, creating a non-modifiable and therefore certain link with the precise place where the value was created<sup>47</sup>.

4. The impact of the Blockchain on the TP phenomenon used by multinational companies to ensure greater availability of data at national level, this would facilitate the use of all methods of transnational profit, but not limited, to the amount of standardized and comparable information on transactions between different organizations. It will make it easier to adopt methods like the CUP “Comparable Uncontrolled Price” Method. This method is considered "the most direct and

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<sup>47</sup> Amato, M., Fantacci, L.,(2018) *Per un pugno di bitcoin: Rischi e opportunità delle monete virtuali*.

reliable way to apply the principles of free competition", but "it is often difficult to find a transaction between independent companies quite similar to a controlled transaction that no difference has a material effect on price". In this sense, Blockchain will help to reduce the difficulty in finding the necessary data<sup>48</sup>.

### **3.3 THE ROLE OF TAX AUTHORITIES IN THE BLOCKCHAIN**

When we talk about information communications between MNEs and the tax authorities we almost always talk about information asymmetry among the actors, in this context the Blockchain will bring a high degree of transparency in the TP's practices.

Blockchain technology is able to give to tax authorities a single source of verified information while improving the standardization and automation allowed by the system, in this way the efforts required both, to the MNSs but also to the tax authority to retrieve the information's, are significantly reduced, giving the opportunity for further auditing in a more accurate way. A further problem that would be created is that concerning the changes brought about by the BEPS action 13, which requires a level of financial information that goes beyond the previous compliance obligations with respect to transfer prices and in a format, that could be incompatible with the procedures adopted until now.

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<sup>48</sup> PwC (2018). *How Blockchain can help reduce Transfer Pricing complexity*, op. cit. pag. 4.

The Blockchain can therefore help in a two way<sup>49</sup>:

1. Regarding the master files and local files required by the MNEs to collect information that has never been provided in the past and concern these points in brief<sup>50</sup>:

- A brief description of the most important services or products offered by the group together with the specification regarding the most important market in which they operate.
- A description of the existing agreements between the members of the group and a functional analysis to understand their contribution to value formation.
- A descriptive list of extraordinary operations occurred in the fiscal year and a description of how the group is financed.
- Information in case they are products of their intangible goods or services and their legal ownership.
- A financial statement and any existing APA (Advanced Price Agreements).

The Blockchain, thanks to its power, would be able to record in real time the information requested country by country and transmit them to the system providing simple data access to a single source of distributed accounting, ensuring

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<sup>49</sup> Nehoray, M., Lemmens, J., Shapiro, A. (2015). *Transfer pricing documentation and country-by-country reporting*, op. cit. pages 32-33.

<sup>50</sup> PwC (2018). *How Blockchain can help reduce Transfer Pricing complexity*, op. cit. pag. 4.

the impossibility of changes by others without the approval of all the members of the group.

2. The second main aspect concerns the fact that blockchain technology provides the possibility to share information from national reports with tax authorities<sup>51</sup>. When country-by-country reports are shared with tax authorities through the Blockchain, consistent sources and tax definitions have been applied since the beginning for the information exchanged, so consistency with tax requirements will be achieved in real time from an idea of control at the end of the process to a control that is made live and in line with the idea of collaboration and compliance with standards.

In this way, the blockchain could help tax authorities to interpret country-by-country relations in a more appropriate and easy way through the transparency and standardization requirements that underlie the structure of the Blockchain system.

### **3.4 THE IMPORTANCE OF SMART CONTRACTS: ADVANTAGES AND DISADVANTAGES.**

The inability to compare and the assimilation of information has been a fundamental problem for tax authorities in defining the policies to be applied in transfer pricing. Comparability is a fundamental requirement in the application of

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<sup>51</sup> Nehoray, M., Lemmens, J., Shapiro, A. (2015). *Transfer pricing documentation and country-by-country reporting*, op. cit.

the arm's length principle and is based on the comparison of "conditions in transactions between related parties (controlled transactions) with the conditions in comparable transactions between independent parties (comparable non-subsidiary transactions "or" comparable)"<sup>52</sup>. This problem of finding and comparing information, however, does not only concern developing countries but also the OECD countries that have introduced the TP regulations. more important is the lack of specific regulation and at this point the administrative choices can play a crucial role.

Unfortunately, not only the data may not be available sometimes, but in many cases, they are not accessible, plus if we add the differences due to transnational factors, we understand how these data require adjustments before they are comparable with others. However, multinationals as well as tax authorities can rely on the Blockchain to solve this problem; with the Blockchain system the data will be more transparent and available in real time. Therefore, there will be greater availability of data to be compared but also a greater level of comparability due to standardization<sup>53</sup>.

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<sup>52</sup> Raskin, M. (2017). The Law and Legality of Smart Contracts. *Georgetown Law Technological Review*, 1, 305-341. Retrieved June 11, 2018, from <https://www.georgetownlawtechreview.org/wp-content/uploads/2017/05/Raskin-1-GEO.-L.-TECH.-REV.-305-.pdf>

<sup>53</sup> The Platform for Collaboration on Tax (2017), *A Toolkit for Addressing Difficulties in Accessing Comparables Data for Transfer Pricing Analyses*, pag. 16. Retrieved June 11, 2018 from <https://www.oecd.org/tax/toolkit-on-comparability-and-mineral-pricing.pdf>

Speaking about standardization and blockchain let's talk about the so-called "smart contracts" in the field of transfer prices. An intelligent contract is a "computer code executed on a blockchain containing a set of rules according to which the parts of that intelligent contract agree to interact with each other"<sup>54</sup>. In a very simple way, smart contracts are nothing more than pieces of code that automatically execute themselves in the event that the conditions are met. They are managed by the Blockchain technology, which uses consent protocols that are previously agreed by the parties, they agree the terms of validation of the contract that will be validated instantly when the terms of the applicant meet those of the recipient and without the participation of an intermediary, given the high level of trust implicit in the blockchain where trust is achieved and the risk of error and manipulation are greatly reduced, Blockchain is in this sense necessary because the parties to the transaction must operate on the same databases. "Child" of the execution of a code by a computer is a program that calculates deterministically (with identical results against identical conditions) the information that is collected, in other words if the inputs are the same the results will be identical. This point is extremely relevant because if on the one hand it represents exempts a certainty and a certainty as it guarantees to the parties an absolute "objective certainty" excluding any form of

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<sup>54</sup> BlockchainHub. (n.d.). Smart Contracts. Retrieved June 11, 2018, from <https://blockchainhub.net/smart-contracts/>

interpretation, on the other it shifts the weight and the responsibility or even the power to decide on the code, on the programming<sup>55</sup>.

If smart contracts are used, the MNS will be able to program the Blockchain in advance, the TP policy and the terms and conditions of intercompany transactions. The smart contracts will then operate on the "if-then" condition in a way that contracts between the parties will be executed automatically only if these conditions are met<sup>56</sup>. All parties can then verify, validate and automatically implement the terms of the agreements. The only difficulty in applying the smart contract is that it is highly standardized. The conditions that give the possibility to smart contracts to be a competitive option for existing technology are<sup>57</sup>:

- Transactions carried out within the group are numerous and frequent over time;
- Transactions executed by the parties consist of manual or duplicate activities.

Here is an example to clarify how an intelligent contract can be used in the field of transactions and to determine the transfer prices of an MNE. We consider an MNE with a high number of branches all over the world and very active in the field of

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<sup>55</sup> Getting smart about smart contracts. (2016, June), Deloitte CFO Insights, pag. 2. Retrieved June 11, 2018, from <https://www2.deloitte.com/us/en/pages/finance/articles/cfo-insights-getting-smart-contracts.html#1>

<sup>56</sup> Bellini, M. (2018, July 02). Blockchain: Cos'è e come funziona veramente, una guida per capire. Retrieved June 21, 2018, from <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

<sup>57</sup> Amato, M., Fantacci, L.,(2018) Per un pugno di bitcoin: Rischi e opportunità delle monete virtuali.

intra-group transactions. A Blockchain system can therefore be built in which all branches actively participate. The TP is therefore designed so that all transactions are in line with the principle of free competition and therefore predetermined using smart contracts. When the company, which we call "Company A", requires a certain amount of goods or services from a different branch, called "Company B", all transaction information is transmitted in real time to the system. As previously stated, the transaction will be validated and the payment from one company to another carried out only if they adhere and respect the TP policies and if and only if the consensus is reached among all participants of the node.

As we can see the advantages in the use of smart contracts are many and try to mention the main ones<sup>58</sup>:

- Speed: Intelligent contracts can automate previously performed activities manually, thus increasing process speed.
- Accuracy: When a process is automated and mathematically predetermined, human errors and data manipulations are less likely to occur because the execution is performed automatically each time they obtain the consent of the entire network.
- Effectiveness: Smart contracts require fewer intermediaries or even eliminate the need for third parties.

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<sup>58</sup> *Getting smart about smart contracts*. (2016, June), Deloitte CFO Insights, op. cit. pag. 2.

- Resolution of disputes: as we have seen before, agreements between the multinational and the tax authorities can be introduced ex ante in smart contracts, reducing the likelihood of ex-post legal disputes.

Although it is clear that from the practical point of view the positive effect coming from the use of smart contracts is evident, the experts of the sector have questioned the validity and legality of these, as several problems have been highlighted<sup>59</sup>:

- The first problem encountered is the fact that the agreement on the TP or other is not applied by any tax authority or force of the order, but is directly executed by terms of the contract itself.
- The second problem concerns the ambiguity resulting from the difference in language used. The human vocabulary is characterized by the diversity that it can assume, the machine language is instead fixed, which would be able to reduce the problem of ambiguity but the perplexities arise about the possibility of translating or transporting each contract in a fixed and pre-established virtual language.
- The third problem concerns how the intelligent contract manages to manage the changes, as the legal matter is constantly developing and the contracts must apply in a satisfactory way these changes immediately, in

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<sup>59</sup> Raskin, M. (2017). The Law and Legality of Smart Contracts. *Georgetown Law Technological Review*, 1, 305-341. Retrieved June 11, 2018, from <https://www.georgetownlawtechreview.org/wp-content/uploads/2017/05/Raskin-1-GEO.-L.-TECH.-REV.-305-.pdf>

our view, this problem is not really found because the mathematical models are more than satisfactory to adopt changes in the system and even faster.

- The last problem that may arise concerns the consequences in case the outcome of an intelligent contract is far from the legal requirements and how to make sure that the programmers of the smart contracts write a code that is in line with the law in force.

These limits are certainly very important and the main question concerns how international law will govern the use of these contacts and the Blockchain. The Blockchain works in a decentralized way as we have already said, it is therefore impossible to identify a law or an applicable jurisdiction in case of specific transactions involving several jurisdictions. "At its simplest level, every transaction could potentially fall within the jurisdiction (s) of the position of each node in the network"<sup>60</sup>, hence the indispensable need for an international discipline valid for all. In this sense, something has moved in the European Union in 2017, where the (STOA) Unit of scientific perspective of the service of the European parliament has begun to identify the potentials related to the Blockchain, noting how a regulatory approach is lacking. However, as regards the Copyright and also how to consider the giants of the web, it is essential to have a means that can act as a guarantor of truth and respect for legality, all these changes on a legal level will take time.

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<sup>60</sup> McKinlay, J., Pithouse, D., McGonagle, J., & Sanders, J. (2018, February 2). *Blockchain: Background, challenges and legal issues* | Insights | DLA Piper Global Law Firm. Retrieved September 20, 2018, from <https://www.dlapiper.com/en/denmark/insights/publications/2017/06/blockchain-background-challenges-legal-issues/>

**CHAPTER 4:**  
**THE BLOCKCHAIN SYSTEM AND REGULATIONS**  
**REGARDING THE TRANSFER PRICING.**

In this chapter, we will see how the biggest problems that the blockchain will have to face will be addressed, those concerning the difficulty of reliable and universally applicable rules in the management of the transfer pricing phenomenon. As we shall see, the guidelines do not give a single directive and their general character and not binding on the possibility for each state to use its own phenomenon management, as we will see thanks to the use of Blockchain technology, even this limit may be exceeded even if it is perhaps the biggest and most difficult step to make since its overcoming it does not depend only on technology but on the willingness of all states to comply.

**4.1 ARMS LENGTH PRINCIPLE**

As already said the arm's length principle definition is reported below as stated in article 9 of the OECD tax convention model: "where conditions are imposed or imposed between the two companies in their relations commercial or financial that differ from those that would be realized between independent companies, so any profits that, due to these conditions, would have accrued in one of the companies,

but, because of these conditions, they were not accumulated in this way, could be included in the profits of that company and taxed accordingly"<sup>61</sup>.

The need for regulation on transfer prices arose after the collection by the United States and the United Kingdom of income taxes. The main reason for the transfer pricing legislation was to prevent the profits from being overpriced or undercut during the course of the first world war. During 1935 the principle of free competition was applied in US tax laws and used as a standard for intra-group transactions<sup>62</sup>. The reason was simple, to prevent the associated parties from shifting profits too easily. The tax authority should therefore have the power to recalculate income, to make sure that it is taxed at the place where it was created. In 1936, it was mentioned for the first time in a multilateral agreement, art. 6 of the convention of the society of nations on the allocation of profits and assets of international companies<sup>63</sup>.

During 1968, rules on intra-group transactions were published by the US government, rules that had a great influence on the development of the OECD. The need for further guidance regarding transfer pricing was necessary due to the increase in multinationals during the 1960s. During 1979 the "Transfer of prices

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<sup>61</sup> OECD (2017), OECD releases latest updates to the Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations. Retrieved April 21, 2018, from <http://www.oecd.org/tax/oecd-releases-latest-updates-to-the-transfer-pricing-guidelines-for-multinational-enterprises-and-tax-administrations.htm>

<sup>62</sup> Avi-Yonah, 2010, Rise and Fall of Arm's Length Standard, p. 97

<sup>63</sup> Ad Hoc Group of Experts on International Cooperation in Tax Matters, 2010, Transfer Pricing: History, State of the Art, Perspectives, p. 6

and multinational companies" report was produced<sup>64</sup>, initially intended as a source describing the problems and considerations that must be taken into consideration and subsequently became a report that contained within it a broad set of rules.

After a number of years, it became clear that the OECD guidelines needed an update to reflect developments in international trade and technological developments. Furthermore, new guidelines were needed to bridge the differences between the US and other OECD countries. In 1995, the OECD replaced the 1979 report with transfer pricing guidelines for multinational corporations and tax administrations. Compared to US regulations, in particular with cost sharing agreements, the OECD guidelines attach greater importance to non-compliance with transactions if a certain agreement between independent parties is not envisaged.

The OECD guidelines have an important influence on the practice of transfer pricing worldwide, even for non-OECD countries. The Guidelines cannot be used only to interpret the provisions of the tax treaty (such as Article 9 of the OECD Model), but also to apply transfer pricing rules for national law. The OECD guidelines are mostly compared to OECD comments on the model convention, but have a slightly greater influence since no objection or reservation is explicitly stated. The last significant update of the Guidelines was made in 2010, which added further indications on corporate restructuring.

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<sup>64</sup> Ad Hoc Group of Experts on International Cooperation in Tax Matters, 2010, Transfer Pricing: History, State of the Art, Perspectives, p. 7

The OECD guidelines can also be used to fill gaps between different systems and resolve disputes. Although the principle of free competition has a significant influence, it also has its weaknesses, for example the absence of clear answers to specific problems.

Over the years, an update of the OECD guidelines was essential to reflect developments in international trade and technological developments. In 1995 the OECD replaced the previous report with guidelines on transfer prices for multinational companies, attributing particular importance to the failure to observe transactions. Since 1995, OECD guidelines have an important influence on the practice of transfer pricing worldwide, even for non-OECD countries. These guidelines are used to interpret the provisions of the tax treaty but also to apply national transfer pricing rules.

Several authors have questioned the relevance of the principle of free competition and have highlighted several problems. The most serious criticism is that the separate entity method lacks economic reality, since multinationals expand internationally and create relationships to avoid inefficiencies and enjoy economies of scale. The second argument that has been mentioned several times is the lack of comparable (especially for intangible assets). For tangible products to find comparable is much simpler, since the comparison can be made on the basis of tangible aspects, such as the material used, the specifications and so on.

Many scholars have questioned the topicality of the principle of free competition and have highlighted various problems. The most critical criticism concerns the inability to manage multinationals that expand globally and create relationships to avoid inefficiency and enjoy economies of scale or the second criticism repeatedly raised is the lack of comparable assets (especially in the case of intangible assets). For tangible products, finding comparable goods is much simpler than that which does not happen on intangible assets and which in recent years has undermined the fiscal authority's *modus operandi*.

Several scholars have criticized the principle of free competition<sup>65</sup>:

- how the principle of free competition ignores the situation in which companies create "relationships" in order to prevent inefficiencies and trade with others at market conditions. A company deliberately crosses borders to create advantages in terms of efficiency; the correction at a market price seems fundamentally wrong.
- Secondly, the principle of free competition creates an incentive to artificially reduce the tax and to allocate profits to countries that apply legal taxes. This is a remarkable statement because the OECD believes that the principle of free competition prevents tax advantages and disadvantages that would otherwise distort the relative competitive positions of both types of entities. He claims that a significant amount of US companies identifies profits in low-tax countries,

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<sup>65</sup> Avi-Yonah, 2010, Rise and Fall of Arm's Length Standard

including the Netherlands. The principle of free competition obliges multinationals to report their income in such a way as to ignore the advantages in terms of cost reduction. This intrinsic indeterminacy pushes multinationals to develop a structure that lowers their payable taxes in order to create the advantages that the principle of free competition ignores.

- The principle of free competition is too complex. Recent transfer pricing legislation requires the involvement of a huge accounting industry, lawyers and economists. Obviously, this implies significant compliance and administrative costs. Although this regulation (in part) solves the problem of transferring profits, it involves enormous costs associated with compliance, administration and litigation. It is also questioned to what extent the tax authorities can effectively control the volume of affiliated contractual transactions. Because of this disadvantage in the information, the tax authorities have increased the layers of complexity to prevent tax avoidance. Moreover, under the principle of free competition, the tax revenues of many countries are relatively low compared to other countries. The principle of free competition creates the possibility of avoiding taxation.

- Since the principle of free competition seems unable to determine a sufficient ex ante solution, ex post evaluation will be the only option left. Complex legislation will be needed to ensure that the profit is taxed at the place where it was created, but also the taxpayer's perspective has been taken into account. Is retroactive

taxation appropriate in all cases and is legal protection as implemented in the OECD guidelines sufficient? Many countries already have the possibility of resorting to ex post taxation and even the final BEPS reports have implemented this option. In general, it can be said that the principle of free competition brings much uncertainty. Neither the taxpayer nor the tax authority can know in advance the probable outcome in a transfer pricing case.

The main argument is that multinationals operate internationally to reduce certain costs through synergy and enjoy economies of scale and scale. The whole development point of an international structure is to effectively internalize costs. When the principle of free competition is applied, the structure will be considered as an unrelated situation, while the advantages offered by related entities are precisely the reason for creating an international structure<sup>66</sup>.

Finally, they come to the conclusion that the mistake that comparable transactions can be found between independent parties is the fundamental problem. This approach would have been realistic in an economy 80 years ago, but transportation and communication technology in today's world makes this kind of comparison no longer realistic. In the early 1930s there were international companies, but they did not have modern technologies, which makes centralized management possible geographically dispersed groups.

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<sup>66</sup> OECD Transfer Pricing Guidelines, 2010, p. 15

## **4.2 A DIFFERENT INTERPRETATION FOR EVERY COUNTRY**

Comparing the transfer pricing regimes of different countries, we realize that the fundamental problem regarding this subject is the different discipline of this method, in short, despite international directives aimed at the regulation of transfer pricing, each country uses a different method. In this chapter, we will describe some of the methods used by different nations. Although most countries follow OECD transfer pricing guidelines, some interesting differences have been found, such as the CWI rule and the so-called hypothetical free competition principle in Germany.

### **4.2.1 Netherland**

The Netherlands refer to the OECD guidelines for transfer pricing regulation<sup>67</sup>. Information regarding this regulation can be found in the "Secretary of State of Finance". This document has provided information on the determination of an intangible. We are well aware of the difficulties concerning the determination of a transfer price at the time of transfer of the intangible, as there is not enough information on the benefits deriving from that asset. assets to another company in the group that does not create any added value is considered not to be market conditions. It is explained that, since the total joint profit will not increase, the asking price will be higher than what a potential buyer wants to give for the good.

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<sup>67</sup> Sporken, E., & Visser, P. (2016, January 21). Intangibles in a BEPS World and How the Netherlands Is Complying with OECD Rules. *International Transfer Pricing Journal*, 23(1), 33-27.

There are also transaction costs, therefore it is considered that in a normal economic situation the transaction will not take place.

#### **4.2.2 United States**

The United States uses a divergent system for the determination of transfer prices for intangible assets. Both the OECD and the United States agree on the principle of free competition, but there are differences. Quoting Burowski: "In the United States, the burden of proof lies exactly with the tax payer, who must prove that his prices are charged at normal market conditions. In Europe, on the other hand, the burden of proof lies with the tax administration, which must demonstrate that the prices are not at market conditions. In the United States, the reports (of the TNCs with the respective tax authorities) are often contradictory, whereas in Europe companies are more used to working in close collaboration with the tax authorities to arrive at compromise solutions. The OECD guidelines focus on how prices are set (a subjective behavior-centered test), while US regulations require a market outcome (an objective test that focuses on taxable income). the IRS's main concern is whether the tax base is correct "<sup>68</sup>.

In general, the United States uses four methods to determine a transfer price for intangible assets.

##### 1- The comparable uncontrolled transaction method

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<sup>68</sup> Tax Analysts. (1996). *Recent European Tax Developments*

2- The method of comparable profits

3- The method of profit sharing

4- Other methods not specified.

The IRS believes that the following assets are intangible assets:

- Patents, inventions, formulas, processes, designs, schemes or know-how
- Copyright and literary, musical or brand names
- Franchising trade marks, trade names or trademarks, licenses or contracts
- Methods, programs, systems, procedures, campaigns.
- Other similar items.

The first method compares the amount charged with comparable uncontrolled situations to assess whether the payment is at market conditions.

The method of comparable profits evaluates the remuneration in a controlled operation with objective measures of profitability. On the basis of assessments derived from uncontrolled tax payers, the price will be equal or less

The profit repair method assesses whether the allocation of the operating profit or loss attributable to one or more controlled transactions is a market condition based on the relative value of each contributor's contribution to this operating profit or loss, the situation should then be confronted with uncontrolled situations that are more strictly identifiable.

The United States distinguishes intangible assets in Normal and difficult to value<sup>69</sup>. For normal goods, transfer price methods can be applied. For the Intangible Assets of difficult valuation, the Commensurate with Income Method (CWI) is applied instead. This rule requires that no ex ante evaluation be made. With the CCWI, it ensures that an intangible if very profitable, can be taxed in an additional manner. The CWI rule is comparable to the ex post method used in BEPS reports, however there are two major differences. For situations occurring in America, the CWi is used on an annual basis and secondly the IRS can make changes that lead to an increase in tax revenues for the United States. This implies that if other countries are also implementing a CWI rule, this could lead to double taxation for US companies.

The CWI rule also has implications for copyright. The CWI rule gives the IRS the authority to recalculate the royalties that were made due to the transfer for sale, the license or the intangible property to related foreign companies. Prices were determined with the market length rule at the time of transfer. Therefore, even if the principle of free competition is taken into account at the time of the transaction, but it shows later that the profit is higher than expected during the following years, it is possible to adjust the royalties. It can be concluded that this provision creates a great deal of legal uncertainty in practice.

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<sup>69</sup> Brauner, Y. (2008). Value in the Eye of the Beholder: The Valuation of Intangibles for Transfer Pricing Purposes. *Virginia Tax Review*, 28(79), 81-164.

This leads to double taxation problems that can hardly be mitigated or resolved.

### **4.2.3 Italy**

In Italy a safe landing method was used for the transfer of intangible assets. The choice of this particular method was considered given the complexity of this type of transaction. However, this system of safe ports is no longer used, but "adequate" rental values have been provided, there are in fact some categories with their respective percentages and conditions of use. All this has done nothing but simplify transfer prices for intangible assets on the one hand but has brought about the great burden of double taxation.

The definition of safe ports is present in the OECD transfer pricing guidelines. It is defined as follows: "The concept of safe ports is organized in the OECD transfer pricing guidelines. The definition of safe harbor, as described in the OECD Transfer Pricing Guidelines, is as follows<sup>70</sup>: "A safe haven in a transfer pricing regime is a provision that applies to a defined category of tax payers or transactions and that relieves eligible tax payers from certain obligations otherwise imposed by a country's general transfer pricing rules "

However, there are many disadvantages when countries choose to implement safe ports<sup>71</sup>:

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<sup>70</sup> OECD Transfer Pricing Guidelines, 2010, p. 74, paragraph 4.100

<sup>71</sup> Zucchetti, S., Pallotta, A., & Lanfranchi, O. (2016). Assessment Methods for Intangible Assets: Unwrapping the Italian Patent Box to Better Grasp What's Inside and How Much Is Worth. *International Transfer Pricing Journal*, 1-9.

- Port security regulations can lead to situations that do not comply with the principle of free competition
- In the event of a safe port being implemented, double taxation could occur.
- Tax planning can be encouraged
- Harbor safety regulations could also affect fairness and uniformity.

In Italy, the best method that defines transfer prices is based on an analysis in which the factors that contribute to the creation of value must be identified. Information on the intangible transfer price can be found in the patent box decree. The CUP method must be the first method to be examined in the hierarchy. The other methods will have to be analyzed only in extraordinary cases. The CUP method is useful when there are internal comparable assets, or if they are not present, external comparable can be searched. The profit sharing method should be applied in line with the international consensus on the residual profit sharing method, ie following a deductive logic for the identification of the "extra profit" attributable to the intangible asset. The Italian tax authorities interpret Article 7 of the Decree on the patent box in such a way as to require a complete alignment between the economic contribution and the total profit of the company in the case of direct or indirect use. Many scholars of international taxation therefore argue that Italian practice differs from the guidelines that are drafted by the OECD.

### **4.3 WHAT IS THE PROBLEM? THE STARBUCKS CASE STUDY.**

The best way to make understandable what many times makes the numerous pages of codes and laws written in archaic language is to present a practical case that can very simply demonstrate what many laws fail to say with the use of loud words.

This paragraph aims to present in practice a case actually occurred in the past to demonstrate how and what the phenomenon of transfer pricing entails if not duly regulated or if better left to today's regulation.

The case that we will analyze concerns a multinational company that operates in the food sector, which has now become a status symbol present all over the world but which unfortunately for us and for many governments has used this lack of regulation to obtain great tax advantages<sup>72</sup>.

The multinational we are talking about is Starbucks and soon we will try to present its history.

With the 2015 ruling, the European Commission stated that the Netherlands granted tax relief to the multinational Starbucks. With this ruling, the commission therefore forced the Netherlands to recover between twenty and thirty million from the company in order to restore market competitiveness.

The commission, reports:

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<sup>72</sup> Baeten, N. Borgers, C. Ford, J. *Commission's tax ruling cases: Fiat and Starbucks decided*, Linklaters, ottobre 2015.

"Tax rulings that artificially reduce a company's tax burden are not in line with EU state aid rules, are illegal and I hope that with today's decisions, this message will be heard by Member State and company governments "Small, multinational or not, should pay their fair share of taxes."<sup>73</sup>

This decision will be very important in the future, in fact, despite the amount requested by Starbucks barely reaches 0.1% of profits in fiscal 2015, it has introduced a new principle that will be used for the next few years and that will report the declaration of the commission that states:

"Tax rulings cannot use methodologies, no matter how complex, to set transfer prices without economic justification and undue transfer of profits to reduce taxes paid by companies."<sup>74</sup>

To understand this point, it is important to analyze and understand the commission method defined as "artificial and complex" used by Starbucks to reduce taxable taxation in the Netherlands.

The companies involved in the process, as mentioned above are<sup>75</sup>:

- Starbucks Coffee Trading Company SCTC (a Swiss company).
- Manufacture Starbucks EMEA B.V (limited private civil liability)
- High Limited Partnership (a limited partnership in the UK).

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<sup>73</sup> European Commission press commission database, Brussels, 21 October 2015

<sup>74</sup> European Commission press commission database, Brussels, 21 October 2015. Op cit.

<sup>75</sup> Bergin, T. (2012, October 15). How Starbucks Avoids U.K. Taxes. *Reuters*.

Starbucks Manufacturing SMBV based in Amsterdam, is the only roaster of the Starbucks group present in Europe. It sells, packages and distributes roasted coffee and products that are processed by them in all Starbucks or Starbucks stores in Europe, the Middle East and Africa. The UK-based company, the so-called Alki, owns the IP or the so-called "know" as "for the universal roasting process for all Starbucks companies. The last but not least is the Company based on SCTC who has the task of buying or buying coffee beans from the international market and then selling it within the Starbucks group and to all those who have a Starbucks license. The story is now easy to understand, as shown in Figure , the SMBV company buys green beans from SCTC at an almost tripled price, according to the completely unjustified commission, since then the profits relating to the international trade in raw materials or raw materials such as coffee are taxed at 5 per cent in Switzerland, if this had happened in the Netherlands it would have been taxed at 25%. It should be noted that over 80% of the company's annual revenue in Amsterdam was paid until 2015 to buy coffee beans, making two accounts easy to understand how the profit was transferred in Switzerland is very substantial. At the same time, SMBV pays very high royalties to Alki UK for the use of its intellectual property, thus shifting profits to the UK where the tax rate is around 24%. But analyzing the profits ended in the UK, they don't stay there long. In fact, in the 2013-2015 period, Starbucks did not register any kind of profit in the UK and therefore did not pay any income tax and this affects a figure of more than 1.2

billion pounds. We are still analyzing the situation in the United Kingdom horrified to note that the average loss of the company in the 2008-2010 fiscal years was on average 37 million pounds despite sales continuing to grow. However, finding an answer to this dilemma is simple: they have evaded the tax authorities through the use of tools such as fees and internal loans<sup>76</sup>.

Alki is an international Starbucks subsidiary, named Emerald City. Now, if this was in turn a Starbucks International member based on a paradise tax, then it would be even more beneficial from the moment you arrived at a tax haven the income is not traceable by the IRS (Internal Revenue Service) because Emerald City is an unlimited number liability company.

Under UK law, unlimited liability companies are not obliged to release certain financial information. This foreign income cannot be taxed if it is returned to the United States. The corporation tax is 35% in the United States, but will be taxed at a lower rate.

This is not all, the Dutch authorities require the payment of taxes for the activity carried out in their territory by Starbucks, however, again here on an average annual turnover of 154 million euros, the average profit of the Dutch tax authorities was about 1.6 million euros, almost 1% of the total.

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<sup>76</sup> Kleinbard, E. D. (2013, June 24). Through a Latte Darkly: Starbucks's Stateless Income Planning. Tax Notes, 1515-1535.

### STARBUCKS OBTAIN ILLEGAL TAX ADVANTAGES FROM THE NETHERLANDS

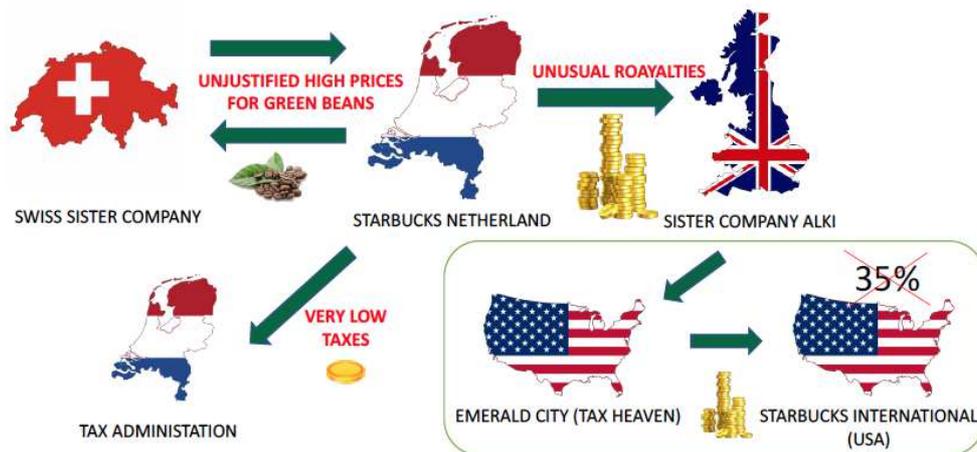


FIG 7 Kleinbard, E. D. (2013, June 24). *Through a Latte Darkly: Starbucks's Stateless Income Planning*. *Tax Notes*, 1515-1535.

This was possible thanks to a price agreement (APA) signed in 2001 between the SMBV and the Dutch tax authorities.

An early price agreement (APA) is an early agreement between a tax payer and a tax authority on an appropriate price transfer method (TPM) for certain series of transactions in question on a given period of time (called "covered transactions").

The purpose of an APA is to eliminate potential disputes over transfer prices in a cooperative manner. The APA in question concerns the determination of the remuneration of free competition for its SMBV performed roasting and distribution functions, and thanks to this, the determination of the royalty payment to Alki for the use of intangible assets such as the process and the distribution know such as.<sup>77</sup>

<sup>77</sup> van der Hurk, H. (2014, January). Starbucks versus the People. *International Transfer Pricing Journal*, 68(1), 27-24.

The Dutch tax system has a law that states that profits are taxed wherever value is created. Starbucks has taken advantage of this law to its advantage because intellectual property rights are not found in the Netherlands, so fees for the use of these cannot be taxed in the Netherlands. The method agreed with the authorities to assess the performance of SMBV and therefore to find out the value of the fees is the so-called "net margin-net margin" method (TNMM)<sup>78</sup>. According to the OECD guidelines, the TNMM analyzes the net profit of transactions within the executed group, calculated by using an adequate percentage. Net profit The indicator should therefore be established by referring to the profit indicator that has the same contributor gains in comparable transactions with independent companies or margin that would have earned an independent company in comparable transactions. However, to be able to determine whether the transactions are comparable with each other, it is necessary to independently analyze all the intra-group and independent transactions without an initial comparison.

According to the European Commission this method is what has led to overestimating the monetary value of the canons.

The commission in fact criticizes Starbucks several things AND did not accept Starbucks' justification for increasing the cost of green beans paid to SCTC, considering that the margin on beans has more than tripled since 2011. This

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<sup>78</sup> Kleinbard, E. D. (2013, June 24). Through a Latte Darkly: Starbucks's Stateless Income Planning. Tax Notes, 1515-1535.

decision shows, and in a way, imposes, the uncertainty of the legal framework surrounding the transfer Price regulation, questioning the interpretation of the OECD guidelines on transfer pricing by Member States' tax authorities. Indeed, it seems clear that Starbucks has legally moved into the tax system of several countries by exploiting the lack of clarity and laws regulating this discipline and that it has also shown how the tax authorities have had to use a force in many unjustified aspects being able to limit even gigantic losses due to a lack of regulation.

The regulatory problems between states and between states and multinationals have thus led to the emergence of a situation in which there is an absolute lack of regulation in which everyone is free to make him move in a field in which there are no universal laws and adaptable to all and moreover, a problem has arisen that it will be difficult to regulate the lack of specific laws to assess the market value of non-tangible assets and also the correct monetary value for copyright<sup>79</sup>.

#### **4.4 THE BLOCKCHAIN TECNLOOGY AND SMART CONTRACT AS A SOLUTION.**

As we have been able to analyze previously, the basic problem behind the regulation of transfer prices is the lack of a binding and mandatory rule for all

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<sup>79</sup> Kleinbard, E. D. (2013, June 24). Through a Latte Darkly: Starbucks's Stateless Income Planning. Tax Notes, 1515-1535.

countries<sup>80</sup>. Unfortunately, the OECD directives or the BEPS actions are just tips to follow that are then reworked by each nation and that eventually creates its own modus operandi in the management of the situation. As we have seen, there are more or less large divergences for each country analyzed in the evaluation of tangible and intangible assets with regard to intra-group transactions. This results in a serious problem, the agreements that the multinationals stipulate with different nations through different mechanisms such as the APAs that allow these multinationals to operate in full legality but not paying the right payment of the sums concerning the taxation in the country in which the value is created through subterfuges, as previously explained through the Starbucks example where some countries prefer to see themselves paid a minimum percentage of taxes in their country rather than nothing and offering the possibility to multinationals to circumvent the system legally<sup>81</sup>.

The basic problem in the principle of free competition must therefore be regulated with the Arm's Length Principle, however this principle must be universalized<sup>82</sup>.

What is meant by this? the insertion of a valid and binding regulation for all member

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<sup>80</sup> Alharby, M. & van Moorsel, A. (2017). Blockchain-based Smart Contracts: A Systematic Mapping Study. *Computer Science & Information Technology*, 7(10), 125-140.

<sup>81</sup> Deloitte (2016), Getting smart about smart contracts. (2016, June), Deloitte CFO Insights, Retrieved June 11, 2018, from <https://www2.deloitte.com/us/en/pages/finance/articles/cfo-insights-getting-smart-contracts.html#1>

<sup>82</sup> Raskin, M. (2017). The Law and Legality of Smart Contracts. *Georgetown Law Technological Review*, 1, 305-341. Retrieved June 11, 2018, from <https://www.georgetownlawtechreview.org/wp-content/uploads/2017/05/Raskin-1-GEO.-L.-TECH.-REV.-305-.pdf>

states both for tangible and intangible assets through the use of the Blockchain and smart contracts, which will bring greater control over information asymmetry and therefore having a feedback in the evaluation transfer prices for the same goods by independent parties, thus avoiding all the problems relating to evasion by MNEs and double taxation by the tax authorities. The fact that this change is radical with respect to what we are used to living today will definitely lengthen the implementation time of this method<sup>83</sup>.

However, in the face of the problems described by us and the limits that the tax authorities are experiencing in managing this mechanism, the problem that may arise is how international law will govern the use of intelligent contracts and the blockchain in general. The main difficulty stems from the fact that the blockchain works in a decentralized world where it can be difficult, if not impossible, to identify the applicable law and jurisdiction that must be applied to specific transactions that may involve players in more than one jurisdiction<sup>84</sup>.

"At its simplest level, every transaction could potentially fall under the jurisdiction (s) of the position of each node of the network"<sup>85</sup>, so the presence of an international discipline is inevitable. The international organization should take responsibility for

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<sup>83</sup> BlockchainHub. (n.d.). Smart Contracts. Retrieved June 11, 2018, from <https://blockchainhub.net/smart-contracts/>

<sup>84</sup> Deloitte (2016), Getting smart about smart contracts. (2016, June), Deloitte CFO Insights, Retrieved June 11, 2018, from <https://www2.deloitte.com/us/en/pages/finance/articles/cfo-insights-getting-smart-contracts.html#1>

<sup>85</sup> Alharby, M. & van Moorsel, A. (2017). Blockchain-based Smart Contracts: A Systematic Mapping Study. *Computer Science & Information Technology*, 7(10), 125-140.

addressing these new problems in order to create a harmonized approach. Some steps in this direction have already been taken by the European Union in 2017, in particular by the scientific perspective unit (STOA) of the European Parliament's research service, mainly aimed at identifying the potential of the blockchain, but still a regulatory approach it lacks. As has already happened with the debate on copyright reform, and how to deal with the web giant who are now more than ever a new ministry of truth, it will take some time to see some new changes in the legal landscape. For this reason, in the coming years, rather than in treaties or international law, the regulation of Blockchains and smart contracts will be left to the custom and practice of individual agents, both taxpayers and the tax administration, to create a network based on trust and reputation. Once this mechanism is created, the implementation and control of intra-group transactions with the related problems both MNEs and Tax Authorities will be only a vague memory<sup>86</sup>.

However, the problem underlying the use of smart contracts as a solution arises when the problem of how international law will govern the use of smart contracts and the Blockchain in general will arise. In fact the Blockchain system works in a decentralized way as we have said from the beginning, in this case it would

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<sup>86</sup> Deloitte (2016), Getting smart about smart contracts. (2016, June), Deloitte CFO Insights, Retrieved June 11, 2018, from <https://www2.deloitte.com/us/en/pages/finance/articles/cfo-insights-getting-smart-contracts.html#1>

therefore be impossible to be able to identify the applicable law or jurisdiction or that should be applied to these transactions.

## **CHAPTER 5:**

### **THE SYSTEM AND THE ORGANIZATION OF THE BLOCKCHAIN.**

#### **5.1 ESSENTIAL CHARACTERISTICS AND IT IS POSSIBLE USE IN THE TAXATION SYSTEM.**

As is clear from the previous chapters 3 and 4, the Blockchain technology of which we have spoken and which was presented in its original form, does not appear in its initial state to be able to satisfy the fundamental requirements to be able to apply it validly to the management of the business of the multinationals and of the transfer pricing analyzed by us.

Despite this, the lack of valid alternatives and the consequent growth in demand by companies and governments of solutions, has created numerous alternatives, which contrast with the initial and original one.

The following are the different possibilities that differ in the level of centralization of the system, in fact we move from a totally centralized system to total decentralization<sup>87</sup>.

On the left you can see a completely centralized system, the classic traditional old-fashioned system, which corresponds to the typical system of banks or

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<sup>87</sup> Baliga, A. (2017). Understanding Blockchain Consensus Models. Unpublished manuscript, Persistent Systems Ltd. Retrieved online on the 13th of February 2018 from <https://pdfs.semanticscholar.org/da8a/37b10bc1521a4d3de925d7ebc44bb606d740.pdf>.

administrations, where a service is offered from a typically monopolistic position. In the diametrically opposite pole, as you can see in the right side of the graph, there are the completely decentralized systems described above by us which correspond to the better-known Bitcoins<sup>88</sup>. As previously mentioned, up until now we have analyzed the subject and proposed solutions based on the idea of the Blockchain open to all. However, in the middle there is a third possibility or better two. The authorized private Blockchain system or the so-called Blockchain of the authorized consortium. In this way, instead of obtaining an anonymous public participation as the decentralized system would like, the Blockchain can request that one or several authorities act as guarantor for participation<sup>89</sup>.

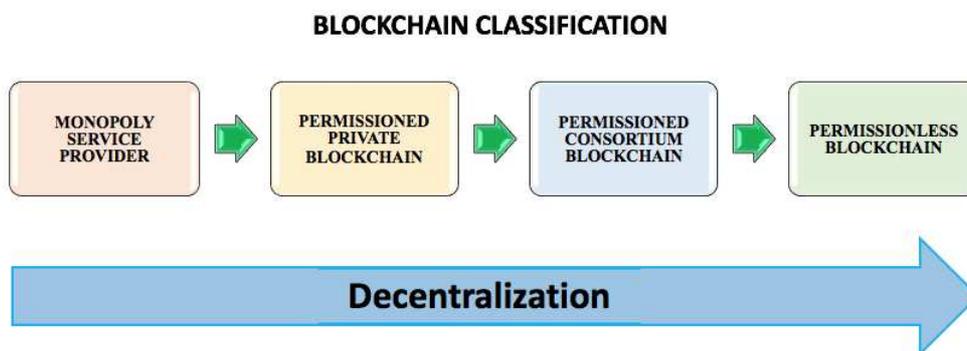


FIG 8 Source: Bellini, M. (2018 - April 11) *Blockchain: cos'è, come funziona e gli ambiti applicativi in Italia*, from <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

<sup>88</sup> Amato, M., Fantacci, L.,(2018) *Per un pugno di bitcoin: Rischi e opportunità delle monete virtuali*.

<sup>89</sup> Mattila, J. (2017), *The Blockchain Phenomenon – The Disruptive Potential of Distributed Consensus Architectures*, Berkeley Roundtable on the International Economy (BRIE) Working Paper, pag. 8. Retrieved June 11, 2018, from <https://www.researchgate.net/publication/313477689>

The difference in the two methods described by us is simple, when the responsible authority is only one we are observing a private Blockchain, when instead the authorities that have the task of controlling the consent of a transaction are more than one we are facing a Blockchain of the authorized consortium. Our objective, considering the subject we analyzed, is to understand which is the most suitable method for the regulation and management of the transfer pricing phenomenon.

## **5.2 PERMISSIONLESS AND PERMISSIONED BLOCKCHAIN.**

The Blockchain without authorization succeeds effectively in guaranteeing a profound respect for the transparency and anonymity of the identities that are involved in the transaction. The fundamental problem discussed so far concerns the fact that anonymity works for many models but not in others such as in the commercial relationship between partners or as between tax and multinational authorities as in our case. For this reason, taking this factor into account, the choice towards an authorized Blockchain, in which there are reliable agents known to all who are part of the chain, becomes almost obligatory<sup>90</sup>.

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<sup>90</sup> Bellini, M. (2018, July 02). Blockchain: Cos'è e come funziona veramente, una guida per capire. Retrieved June 21, 2018, from <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

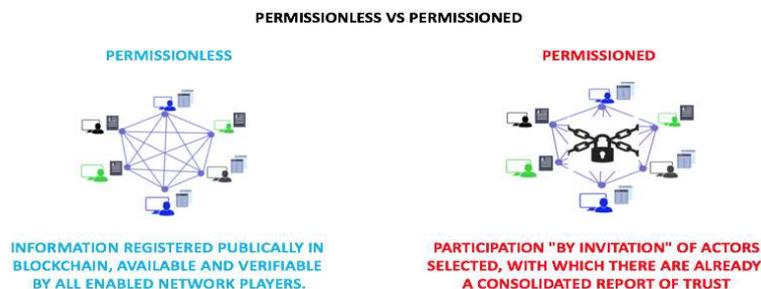


FIG 9 Bellini, M. (2018 - April 11) Blockchain: cos'è, come funziona e gli ambiti applicativi in Italia, from <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

Another important factor to take into account regarding transparency concerns the protection of sensitive data. In a Blockchain without authorization, transparency is fundamental and guarantees anonymous agents to carry out transactions without the need for central governance. In an authorized Blockchain, transparency is a requirement that is not met by network members but is more important in the case of unlicensed Blockchains<sup>91</sup>. In this case an authorized blockchain, in which the information remains private between a group of people and therefore remains confidential, manages to guarantee a more appropriate solution.

With pros, however, there are always negative aspects, and in fact reducing the degree of transparency increases other problems, such as when the Blockchain is led by a consortium of companies or in other cases by a single agent, the blockchain rules can be restored. This is not totally negative but in order not to compromise

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<sup>91</sup> WU Global Tax Policy Center of Vienna University of Business and Economics (2017), *Blockchain 101 for Governments*. The Committee of Experts on International Cooperation in Tax Matters Fifteenth Session, pages 4-5. Retrieved June 11, 2018, from [http://www.un.org/esa/ffd/wp-content/uploads/2017/10/15STM\\_Blockchain-101.pdf](http://www.un.org/esa/ffd/wp-content/uploads/2017/10/15STM_Blockchain-101.pdf)

confidence in the chain's fairness, it is important to reach the majority of the users on the network that do not compromise the essential advantage of the technology and prevent the risk of tampering<sup>92</sup>.

As we have said before, the distinction between permissionless and permissioned is clear, however, as regards the Blockchain Private or Permissioned blockchain, in order to function, four great elements must be present<sup>93</sup>:

1. Infrastructure, private block chains must rely on reliable or widely tested private or closed networks. The security of these solutions is directly linked to the ability to guarantee the impenetrability of the network by subjects who are not authorized. The infrastructure consists of networks and nodes.

2. Ecosystem, Private or Permissioned blockchain<sup>4</sup> are populated by a series of actors who must rigorously share the same values and the same rules. The principles also apply to companies that are required to provide Private blockchain services both at the level of infrastructure, application development and services. All the actors are called to give life to an ecosystem, or to share also in all the activities of planning, development, management of the Private blockchain the Governance rules which then must be implemented with the companies that will use the blockchain.

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<sup>92</sup> Bellini, M. (2018, July 02). Blockchain: Cos'è e come funziona veramente, una guida per capire. Retrieved June 21, 2018, from <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

<sup>93</sup> Bellini, M. (2018, July 02). Blockchain: Cos'è e come funziona veramente, una guida per capire. Retrieved June 21, 2018, from <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

3. Applications, development companies, software houses, system integrators or application providers that create solutions for private blockchains are called to work in the form of a strictly tight and controlled partnership with infrastructure providers. The application component in Private blockchains is closely linked to the technological and governance logics defined by the companies focusing on infrastructure.

4. Governance, the Private or Permissioned blockchain is based first of all and above all on a set of rules shared by all the actors. The rules are part of the development and to implement a Private blockchain it is necessarily to work in the planning and design phase both on the Infrastructure and on the application logic. Governance is an integral part of the design process and represents the basis on which production activities are then implemented as a set of rules that allow first of all to guarantee the absolute safety of the blockchain for all the players and of course the achievement of the objectives of business of companies and organizations that will be called to use it.

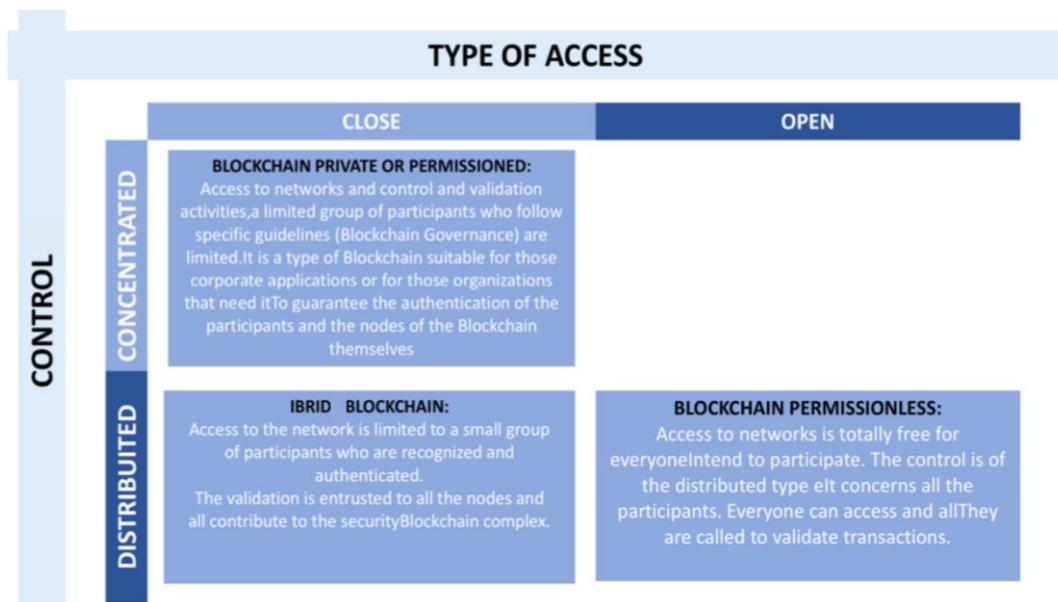


FIG 10 Bellini, M. (2018 - April 11) *Blockchain: cos'è, come funziona e gli ambiti applicativi in Italia*, from <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

### 5.3 THE BLOCKCHAIN CONSENSUS AND ITS PERFORMANCE.

However, the Blockchain we know as Bitcoin has a great deal of technical problems regarding the performance with which transactions take place. In fact, the period between the creation of a transaction and the moment in which it is accepted by all members about an hour with a maximum allowed number of transactions of seven remains very high<sup>94</sup>. Further to this we must also include that the amount of information that is included within the message and that it is validated is only 1mb with a rather significant consumption of electricity. Considering that large

<sup>94</sup> WU Global Tax Policy Center of Vienna University of Business and Economics (2017), *Blockchain 101 for Governments*, op. cit. pag. 5.

companies are designed to support more than 1000 transactions per second, the size of the problem can be understood.

The considerable amount of expenditure comes from the blockchain mechanism, in fact, while in the public blockchain where anyone can participate by maintaining his secret identity, the only way to allow a relationship of trust between the actors and the Proof of Work (Pow)<sup>95</sup> that as we have described above is very expensive in the field of computational energy, in the tried blockchain system the (pow) is no longer necessary, as usually the Byzantine Fault Tolerant protocols are used, or in any case on methods based on consensus based on a majority, as described above.

The consequence of a private mechanism, that is when all the participants in the network are known and known, the consensus mechanisms that are much cheaper as the BFT manages to guarantee the network a faster and more efficient process since all the transactions are verified only by some nodes and not from the whole network but above all it manages to guarantee great savings in economic terms.

To not forget anything, we must add that the blockchain we previously presented based on proof of work is characterized by large dimensions both in terms of block and in terms of frequency. When the size of the block touches huge peaks, we will have to deal with a growing latency for the approval of every transaction, as the larger blocks require more time, with the consequent negative implication regarding

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<sup>95</sup> Vukolić, M. (2016), *The Quest for Scalable Blockchain Fabric: Proof-of-Work vs. BFT Replication*, IBM Research – Zurich, pag. 2. Retrieved June 11, 2018, from doi:10.1007/978-3-319-39028-4\_9

security and the possibility of have a fork. The BFT protocol, has none of the problems previously described in the POW, indeed it has a greater number of approved transactions and a higher frequency.

Despite the problems related to POW it has been shown that this method works even in the presence of thousands of nodes. Instead the BFT method protocols have never been tested in situations with more than 10 or 20 nodes<sup>96</sup>.

To conclude another problem is that related to the purpose of consent. In practice, the basic idea is that if a block is added to the chain, the block will never be removed in the future. Through POW method to be sure that a transaction will not be restored in the future, the block in which it was included should be followed by several other blocks. This succession of actions unfortunately does not occur with the BFT system.

#### **5.4 THE RECCOMENDED CONFIGURATION.**

During this last chapter, we discussed a great deal about permissionless and permissioned Blockchain, presenting the different characteristics of each, in this paragraph we will be able to observe them closer by comparing them.

As you can see from the fig.11 below each blockchain has a specific feature that creates a consequence in its use<sup>97</sup>.

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<sup>96</sup> Vukolić, M. (2016), *The Quest for Scalable Blockchain Fabric: Proof-of-Work vs. BFT Replication*, op. cit. pag. 7.

<sup>97</sup> Vukolić, M. (2016), *The Quest for Scalable Blockchain Fabric: Proof-of-Work vs. BFT Replication*, op. cit. pag. 4-7.

	PERMISSIONLESS POW CONSENSUS	PERMISSIONED BFT CONSENSUS
NODE IDENTITY MANAGEMENT	OPEN, ENTIRELY DECENTRALIZED	PERMISSIONED, NODES NEED TO KNOW IDs OF ALL OTHER NODES.
CONSENSUS FINALITY	NO	YES
SCALABILITY NO. OF NODES	EXCELLENT (THOUSANDS OF NODES)	LIMITED, NOT WELL EXPLORED (MAXIMUM 20 NODES)
SCALABILITY NO. OF CLIENTS	EXCELLENT (THOUSANDS OF CLIENTS)	EXCELLENT (THOUSANDS OF CLIENTS)
PERFORMANCE (THROUGHPUT)	LIMITED (POSSIBLE OF CHAIN FORKS)	EXCELLENT (TENS OF THOUSANDS TX/SEC)
PERFORMANCE (LATENCY)	HIGH LATENCY (DUE TO MULTI-BLOCK CONFIRMATION)	EXCELLENT (MATCHES NETWORK LATENCY)
POWER CONSUMPTION	VERY POOR (POW WASTE ENERGY)	GOOD
TOLERATED POWER OF AN ADVERSARY	≤ 25% COMPUTING POWER	≤ 33% VOTING POWER
CONFIDENTIALITY	LOW	HIGH
NETWORK SYNCHRONY ASSUMPTIONS	PHYSICAL CLOCK TIMESTAMPS (E.G. FOR BLOCK VALIDITY)	NONE FOR CONSENSUS SAFETY (SYNCHRONY NEEDED FOR LIVENESS)
TRANSPARENCY	HIGH	LOW
FLEXIBILITY	LOW	HIGH
CORRECTNESS PROOFS	NO	YES
SECURITY	HIGH	LOW

FIG 11 Vukolić, M. (2016), *The Quest for Scalable Blockchain Fabric: Proof-of-Work vs. BFT Replication*, op. cit. pag. 4.

The use of a public blockchain as we have repeatedly repeated manages to guarantee a greater level of security dictated by absolute transparency and a much lower risk of falsification. On the other hand, upside down in the case of blockchain with permission, where the performances are higher, it is possible to guarantee the respect of the confidentiality of the information but it is necessary to accept a reduction in security and a more concrete possibility of tampering and falsification<sup>98</sup>.

The decision to use one or the other therefore remains a choice dictated by the need for the use to be made of it.

<sup>98</sup> Sim, T., Owens, J., Petruzzi, R., Tavares, R. J., Migai, C. (2017), *Blockchain, Transfer Pricing, Custom Valuations and Indirect Taxes: The Potential of the "Trust Protocol" to Transform the Global Tax Environment*

In so far as we are talking about the transfer pricing discipline and therefore we find ourselves in a borderline situation between business and jurisprudence as we talk about regulation of intra-group transactions, the authorized blockchain would carry out the work in a more appropriate manner and would be more adaptable to the discipline of this matter, rather than a pure and therefore open Blockchain system. Moreover, this choice is confirmed by the fact that both governments and multinationals and partner companies cannot and do not want to reveal sensitive data concerning their interests, thus making them completely accessible and accessible to all.

Our propensity for a chain in which only certain subjects have the possibility to access is dictated by the fact that in this way it is possible to obtain the right balance between confidentiality and transparency that in a pure system would not be possible.

To this we must add the high level of performance that the permissioned Blockchain guarantees in the field of intelligent contracts and flexibility, flexibility which is a very important feature as the process of consent or other regulations can be easily modified, which in the blockchain pure would not be possible.

All these factors make the authorized blockchain a very interesting solution that is not without its problems, the main ones are<sup>99</sup>:

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<sup>99</sup> Bellini, M. (2018, July 02). Blockchain: Cos'è e come funziona veramente, una guida per capire. Retrieved June 21, 2018, from <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

1. **Integration:** The fundamental problem regarding the changes derives from the difficulties that emerge in the replacement of the old systems to accommodate the new ones, also in this case it would be a question of replacing the present intragroup agreements and the systems used by the multinationals and the governments. For this reason, rather than witnessing a complete and general revolution, the most attractive solution will be to change step by step, passing to a hybrid system, in which the blockchain system will be developed together with existing databases without revolutionizing everything.

2. **Versatility and Universality:** The greater the spread of the blockchain model, the greater the need to use universal solutions, such as the use of generic standard programming languages that are valid for all, as opposed to what happens so far for example with smart contracts written in line specific to each use.

3. **Collaboration and coordination:** The computer, mathematical and digital nature of the system and the characteristics of the companies in question (MNEs), which have transnational characteristics, make collaboration between jurisdictions indispensable for the application of the best possible law.

4. **The tax authorities:** These are the most controversial thing about the blockchain system as the presence and involvement of the latter in the system is still under discussion today. Several solutions have been proposed and the most valid could be to involve the tax authority as a participant in the system. In this way they will be able to carry out real-time control of the transactions that take place between

companies and check whether or not they adhere to the much-discussed principle of free competition, only after the go-ahead and if and only if the requirement of free competition is validated the transaction will occur. In this way, everything will be verified in real time. However, the tax authorities in this way would have access to all the information gathered by the multinationals regarding intragroup transactions that could undermine the respect of confidentiality, which however could be resolved through an adjustment of the tax regulations by the government so that an effective transfer pricing control is obtained<sup>100</sup>.

## **CONCLUSIONS**

The aim of this thesis is to focus attention on a much-discussed topic such as transfer pricing and Blockchain, a topic that due to technological obsolescence and the unwillingness to update the tools used to deal with it remained stagnated in the situation previous one. In recent years, however, numerous innovations have been noted in the field of transfer pricing, which have paved the way for the entry into science of Blockchain technology, which is thought to have a leading role within this discipline.

As we discussed in our thesis, the adoption of blockchain will lead to an increase in information regarding the contribution of each entity in the creation of value,

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<sup>100</sup> Vukolic, M. (2018, February 12), *IBM Research: Behind the architecture of Hyperledger Fabric*. Retrieved June 11, 2018, from <https://www.ibm.com/blogs/research/2018/02/architecture-hyperledger-fabric/>

thus also helping the multinationals to meet the new documentation requirements proposed with the BEPS and from the OECD. Furthermore, the possibility of being able to access numerous data, being able to compare and automate certain actions through the use of IT tools such as smart contracts make the Blockchain technology an even more interesting solution.

However, as we have seen in chapter 5 of our thesis, the pure blockchain as it is intended remains very distant from the requisites required to make it validly applicable to the context of international taxation. For this reason the two Permissioned and Permissionless Blockchain methods have been proposed to compare the two ideas and to demonstrate how the permissioned is more adaptable and is able to operate in the field of international taxation.

In order to make the Blockchain fully operational, however, there are many challenges to be faced both in the legislative sphere as analyzed in chapter 3, where we are faced with a jagged regulation that does not allow a single vision and management of the transfer pricing problem both regarding the transfer pricing procedures, the role that the tax administration covers in this area and its involvement in the transfer pricing discipline which is still not entirely clear and defined.

Having to give a conclusion to the work we have done we can say with extreme certainty that today the Blockchain system is still very distant in satisfying the indispensable requirements in the discipline of transfer prices, however the

technology is very young and is in full development. It is interesting that if on one hand the level of attention that accompanies the blockchain is very high on the other, the number of concrete cases, of projects actually in production in companies and organizations is still rather small.

In this regard, it is interesting to see the key to understanding the evolution of the blockchain that Capgemini offers in the research "Does it hold the key to a new age of supply chain transparency and trust?" There are three waves of the blockchain according to Capgemini<sup>101</sup>

1. Awareness - started in 2011 is still ongoing. In which companies and organizations trying to understand, to develop knowledge
2. Experimentation - According to Capgemini it started in 2017 and will last until 2020. Companies and organizations work at PoC to create skills, forms of collaboration, devise new consortia, with the aim of fully understanding the potential and criticalities of the blockchain.
3. Transformation - We will see it starting from 2019 and will accompany us until 2025 and in this period the blockchain will transform the relationship, integration and collaboration modalities bringing innovation to more levels: technology, data management, governance.

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<sup>101</sup> Bellini, M. (2018, July 02). Blockchain: Cos'è e come funziona veramente, una guida per capire. Retrieved June 21, 2018, from <https://www.blockchain4innovation.it/esperti/blockchain-perche-e-cosi-importante/>

As for the debate, already underway on the benefits of the blockchain in international taxation, it will be continued, more and more concrete solutions will be developed along the way.

Following this vision, we are positive and confident that there will be practical cases of application of Blockchain in the field of transfer pricing, a lot of research will still have to be carried out and to deal with the solutions of road accidents that will be found, think only of the difficult cultural opposition with the which all new tools have to deal with.

The main interest in this thesis concerns a future comparison between the theoretical benefits presented in the preparation of this work and the practical benefits that will be highlight in future research, analyzing if they occur following the same or a different line from that one expected in theory.

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