ROMANIAN JOURNAL OF INFORMATION SCIENCE AND TECHNOLOGY
Volume 21, Number 2, 2018, 114–128

IT Driven Distributed Consensus for an Integrated Globalized World

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Abstract The blockchain technology, BCT, will provide one of the main web-tool of the future, featured with what will be the true peer-to-peer relation, free of the third part, dysfunctional and problem maker term. In the same time, Artificial Intelligence, comes out from the last *AI winter* with an irrepressible openness for socially requested applications. Both, are ready to support dramatic changes in how our complex and dynamic world is governed. The decision mechanism, at any level in our society, can be improved by the use of the last information technologies, ITs. The main malfunctions of our world are reviewed in order to correlate them with the possible solutions provided by the emergent ITs. The BCT is presented and its use in the making decision process investigated. The impact on the foreseen iDemocracy, iConsensus and iGovernance is evaluated.

Keywords: blockchain, distributed consensus, distributed ledgers, leaderless democracy, iDemocracy, iConsensus, iGovernance.

Democracy is a pathetic belief in the collective wisdom of individual ignorance.

H. L. Mencken [1]

1. Introduction

It seems that the emergence of the new information technologies, ITs, in our too fast evolving world, disturbs the *human being* behavior with itself, with its *world*, and with the whole *existence* embodied in the surrounding nature. In the triad *existence–human being–world* the last component has the highest dynamic, which is based on its formal, rule-based foundation. In this respect, ITs, as part of the world, represent a challenge for which we are not yet ready to answer in an appropriate way. In a book describing one of the most advanced information technology we find the following:

> *How can we accelerate the human transformation required to keep pace with accelerating technological innovation and disruption? ... Governments, the private sector, the civil society, and individuals need to collaborate to forge new common understandings.* ([2] p. 308)

Indeed, various ITs represent good and/or bad surprises for most of the human recipients. The relation between *each* human being and the world, we *all* the human beings developed, became very tense. The poet and scholar Lewis Hyde addressed the essence of the problem:

> *In the present century the opposition between negative and positive reciprocity has taken the form of the debate between "capitalist" and "communist", "individualist" and "socialist"; but the conflict is much older than that, because it is an essential polarity between the part and the whole, the one and the many.* ([3] p. 47)

How can we ***decide*** what is good for each of us and for all of us in the same time? The vote looks like as of the majority dictatorship, as many have told us. Could the ***consensus*** be the solution? Is the current and emerging ITs capable of allowing the majority decision to be replaced by a negotiated consensus? We believe that the way toward the negotiated consensus goes through various forms of democracy, like liquid democracy and participatory democracy, both supported by emergent ITs.

In this paper we investigate the possibility to use blockchain technology, BCT, to design and implement decision mechanisms able to improve the way our world works. The second section points the main issues our world is facing. In the third section BCT is shortly described. The architecture of the proposed decision mechanism is described in the fourth section.

2. Main problems of contemporary societies

2.1. Globalization without integration

The main problems of our world are generated by the process of globalization which evolves without the mandatory integrative process. At the global level, various aspects of economy, of society, and of the political environment evolve uncorrelated.

There are big disparities between the globalization at the level of states, corporations or non-governmental organizations, NGOs. The globalization degree is very advanced at the corporate level. At the level of states there are little hopes. While in the case of NGOs, there is no hope in the current context.

In these conditions, the corporations have too much power to interfere in states' affairs without any hope to find a help for states from NGOs. The interferences take place mainly at the level of the *decision mechanisms*, with disastrous effects on the main socio-economic equilibria. It is too obvious that democracies struggle, less and less successfully, to govern nations, while capitalism runs, with more and more aplomb, the world.

An integrative globalization assumes independent and mutually acknowledged decision mechanisms in the three pylon environment of our world: *states – corporations – NGOs*. We dream for a democratic state, and accept the idea of totalitarian corporation, but we must keep the two mechanisms independent as much as possible. The state does not interfere in the corporate decision, while the corporate money must be kept far from the state's decision. A good integration means an appropriate separation at the decision level. If NGOs were what they claim to be, then they could be of great help in this process. But, unfortunately, they are not.

2.2. A too fast evolving technological environment

The way technologies evolve for solving real problems is too fast for a consistent assimilation at the level of the current human and social behavior. In the last century, technology was, more than ever in the human history, equally a solver and a generator of problems. In other words, there are too many side effects in a fast evolving technological environment.

Technology changes the world with the human being inside. But, unfortunately, the *time constants* of the processes in our world are small compared with the time constant of the adaptation process inside a human being. The clash between a too dynamic world and a too inertial human being triggers a lot of the current malfunctions of our society.

On the other hand, technology generates new forms and rules in various formal and rule-based organizations of our world, without a corresponding change of the formal organization of the entire world. The world is "surprised" by the new mechanisms provided by technology and is unable to assimilate them in "real time".

Bad people or bad organizations take advantages from these discrepancies, while good people and good organisations (if any) are submitted to hard times.

2.3. Various forms of feedbacks in economy

One of the most fallacious belief is that the economy is fully regulated by the negative feedbacks the free market provides. Partially, the negative feedback indeed acts, but only for the low-tech market. In the same time, the positive feedbacks are also there! Brian Arthur, in its seminal paper [4], introduced two concepts: *increasing returns* (once the initial investment has been made, returns increase, with each copy is produced, at low or no price, and sold) and *network effects* (once a product is on the market, it generates a family of products that diminishes the chances of a similar product entering the market).

Taken together, in the hi-tech market, the increasing returns and the network effects allow the hi-tech companies to gain a dominant position on the market. The only condition for them is to enter early on their specific market. Then, the time does its job: as their share grows, it becomes more and more difficult for others to dislodge them. Thus, the positive feedback forces govern the hi-tech markets.

The simultaneous presence of the negative and positive market feedbacks requires appropriate decision-making mechanisms to avoid the instability generated by the complex feedback that may arise.

2.4. Continued growth of economy

The obsession, became law, of the continuous growth of economy is another fallacy of our understanding about how the economic mechanism works. It is combined with the pitfall of the continuous progress. On top of them is the belief in the free and self-regulated market.

Indeed, in the absence of a collaborative interaction between state and corporations, the only way to consider the success in the corporative space is the continuous grow. The only alternative, in the absence of an acceptable regulatory environment, is the decline. An ideal, floating around an optimal point of operation, can not be imagined without an additional feedback loop through the environment in which corporate space acts. There are no worldly entities, in what we call democratic world, to dare closing such a "politically incorrect" loop. Then, the only way is to target an "exit", which, unfortunately, almost regularly is a crash induced by a clash. Usually,

is a clash between a mental construct and a physical limitation. Then, when the "trans-police" comes, the mental construct is found guilty.

2.5. Utopia & democracy

We must accept that any socio-political project is at least partially utopian, because as a project it is rational and rule-based, but, in fact, as an operating system it interferes with human beings who claim only to be rational and comply with the rules, but they do not. The mixture of rules and beings applying them offers an unpredictable reality. Democracy is a rational, rule based construct that become utopian when human beings enter the scene. There are several reasons why the concept of democracy needs to be reconsidered.

2.5.1. Representative democracy is a coarse approximation

The initial from of democracy, the Greek democracy, was a direct, participatory democracy. All the adults allowed to participate to the decisions (no slaves, no alien, no female) where involved directly. Various forms of representative democracy started with late Middle Ages in northern Europe. They where of representative types for "technological" and financial reasons: decision makers could meet only rarely and in small groups. Thus, the opinion of the peoples is considered in a too mediated form, because the representatives are rarely elected and they rarely meet. Ones opinion is twice approximated. Firstly, it is expressed and sustained by an intermediary. Secondly, the opinion of the representative is sampled by a third part authority represented by various ideologies.

The main side effect of the representative democracy is the occurrence of the political class which in time evolved into a parasitic element of the contemporary society. The political class, not politics, is an historical product for a limited time interval. It will fade away (we hope) with the expected improvements of the IT driven decision mechanisms.

2.5.2. Democratic decision is a phase dependent process

Some theoretical aspects of the control theory are completely unknown by the advocates of a society led by representative democracy mechanisms. Who claims that "people have control because they vote for representatives" do not take into account the *phase condition* of each control loop. If the loop delay is high (the phase shift between output of the system and the regulatory action is high) then a loop designed to adjust will generate instabilities or blockings in the nonlinearities of the system. Indeed, if the system does not support rapid changes, then it introduces a worrying delay between decision and action. If the delay is too high, then the decision generates an opposite effect to the one intended.

If voters have to vote every few years, the loop is closed with too long a delay (with a big phase shift). But if they can express their opinion more often (with a small phase shift), the system will be forced to obey the people, otherwise the opinion of the people comes too late and does not matter.

2.5.3. Democracy is competence dependent

Democratic mechanisms are used to make decisions about specific issues. Each specific issue requests specific competencies. Therefore, no one is equally competent for each raised issue. The

level of understanding, the access to the specific information, and the individual experience put each actor, involved in the decision mechanism, in a very different position related to the decision to be done. If we consider all the possible voters, their mean competence for any issue will be very low. Then, what could be our confidence in the resulting vote? Obviously, very low. How can increase our confidence in the results of the voting mechanism we now exercise? Only by using a vote which depends on the competence owned by each voter for the issue submitted to vote. The good news is: the current ITs offer encouraging opportunities for organising such a vote. The bad news is: there is no visible enthusiasm for this approach.

2.6. Lack of balance between decision forms

In a very technical book on electronic engineering, a distinguish American Professor, Ian Parberry, stated (see [5] pag. 22.):

> *Our confidence in the adding algorithm can be analyzed using the rhetorical techniques established thousand of years ago in ancient Greece. The ancient Greek philosophers classified formal argument into three distinct classes:*
>
> - **Ethos***: Proof by authority. ("I am the teacher, and I say that it works.")*
> - **Pathos***: Proof by emotion. ("It would make me happy if you believe that it works.)*
> - **Logos***: Proof by logic. ("Here's how it works . . . .")*
>
> *Our initial confidence in the addition algorithm comes from the ethos or pathos of our teacher (preferably the former, but lamentably often the later), and increases as experience verifies that it is indeed correct. Logos often comes much later, if at all.*

The confidence we have in the decision mechanisms in our world must, indeed, fulfill, in a well balanced way, three criteria. According to them, there are three forms of authority when a decision is required.

In the last weeks of the Second World War, the *logos* advised the Japanese generals to stop the battles, while the *pathos* forbidden them to lay down their weapons, but the Emperor (the *sacred* entity) have said to them: "Stop the War". And the Second World War is over.

2.6.1. Rule-based authority

The democratic mechanisms for decision is based on well formalized rules. Its authority is given by the way mechanism was established and accepted. The authority comes from a form. If the form is fulfilled, then the decision is correct and it is accepted by all the people involved. Once established, the mechanism is not questioned.

The democratic vote is one of this rule-based decision mechanism. All of us believe it is the best wrong mechanism to decide, but consider we do not have a better one. This attitude can be reconsidered in the context of the emerging ITs.

2.6.2. Elitist authority

There are various forms of elite. Intellectual elite, corporatist elite, political elite, and too many other types of elite compete for a preeminent position in the complex process of decision in our too dynamic world. The elitist way to influence the evolution of our life makes meaningful contribution to the collective *Weltanschauung*, with a high contribution on the way rule-based

authority is exercised. The way in which the authority of the elites is exercised can be positive, but also bring great harm.

Unfortunately, the intellectual elite is less capable of convergent actions, while less well intentioned elites are very skilled in forming very active pressure groups.

2.6.3. Sacred authority

There are situations when the rule-based authority decides one solution, while the elitist authority decides the opposite. In this unwanted case, a third authority must impose the solution. This third authority is considered ***unquestionable***. In a well balanced world, it must intervene as rare as possible. But in critical conditions it is unavoidable.

The sacred authority comes from an entity capable of deciding between Good and Evil.

When both, the rational, rule-based distinction between Truth and False, and the cultural, elite-driven distinction between Valuable and Non-Valuable fail to decide, only the sacred, ethical distinction between Good and Evil is capable to provide a decision.

The danger looks like it is hidden in some of the various forms offered by the elitist decision. In [6] I commented, starting from a very deep comment of Lev Nikolayevich Tolstoy, on a sort of meta-convergence between the rule-based and sacred authority.

2.7. Decision & technology

The chain *technology – business – control* ends in a fork: the control is twofold. Corporate control & users control. Strange to say, more dangerous is the users control. Facebook, Twitter, and the like, provide the unpredictable environment where anyone can disseminate its pathetic mental behavior. Corporations are also in control, but more powerful becomes the anonymous behavior of goal oriented collectives of disoriented people.

In the environment shaped by the continuously evolving ITs, who and how decide?

The main characteristic of the relation *decision – technology* is that the "bad" elites use technology explicitly, while the large group of voters are submitted to the technologically driven effects. In the same time, the "good" elites are reluctant in using ITs for decision purposes.

The *rule-based* decision uses mainly the same technology used in the XVIII-th century.

The *elite-driven* decision benefits fully by the up to date technology to shape the public opinion.

The *sacred-imposed* decision is not possible in our world that becomes increasingly profane (profane as opposed to sacred, not profane as opposed to religious).

How we expand the role of IT in the domain of rule-based and/or sacred-imposed decisions? We will try to present, in the following sections, at least the beginning of the story.

3. A mature information technology: blockchain

This section describes a promising technology. It is developed in the larger context of an economic, social and political environment dominated by an exponential spread of ITs in all the aspects of our life.

According to almost all analysts (see for example [7]) the three fundamental driving technological forces:

- *rendering the things digitally* as data (or information, related to the human user) they become amenable to specific form of manipulation; a growing number of things are "embodied" in digital form (music, movies, money, ...), while only some of them are then converted by manufacturing in objects
- the *exponential growth of hardware capabilities* according to Moore's Law, although in the last years the growing rate starts to be differentiated: there is a slowdown for complex circuits (for example: mono-core processors), remaining high for simple modular structures (memories, cellular engines, ...)
- *programmability* as the main way to increase the functional complexity leading to what is called *embedded computation*, the main way to keep the structure reasonable simple and, in the same time, to capitalize on the outcome of Moor's Law, with its two main aspects:
  - the explicit programming using various high level languages
  - the deep learning mechanisms of configuring the weight matrices of the increasingly used deep convolutional neural networks

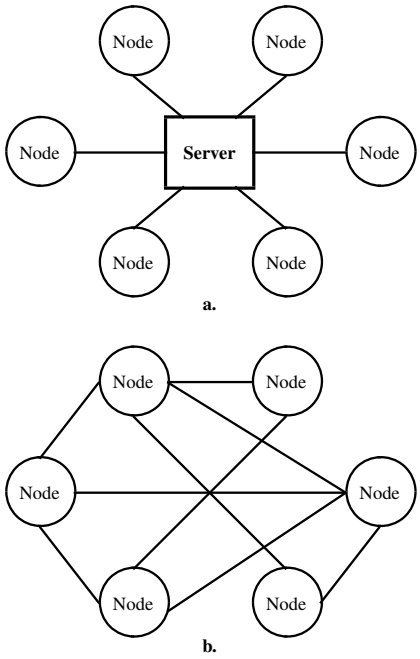

Fig. 1. Centralized vs. decentralized network. **a.** Centralized client-server network. **b.** Decentralized peer-to-peer network.

led to:

- the *consumerization of the digital* as the big shift from a market where the primary customers were private business and government agencies to the current market developed for consumers first and only then addressed to business or governmental agencies; an industry

centered on mainframes in the second half of the XXth century is now personal device centered

- the *digitalization of the physical* by promoting as much as possible goods in digital form (example: eBooks, audio books, digital planner, iPAL, ...) or in digitally controlled gadgets (example: iDog, cleaning robot...)

- the *emergence of decentralized peer-to-peer* in connecting institutions and individuals avoiding centralized control (see Fig. 1) with tremendous effect on the speed and trust

- the *digitization of trust* which opens the door for a lot of applications unthinkable before; maybe the most spectacular new domain will be related to the distributed consensus in making decisions.

In this context, let's start looking on how the BCT [8] [9] could be considered as a technological support for reshaping the decision mechanism at any level in our world. It is already stated that:

> *Blockchain can bring financial infrastructure to people who have no access to it without the intervention of banks. It can do the same with voting. In a similar way, if Blockchain technology were applied to a system of governance, it would serve as a way to source a true form of consensus.* (see [10], p. 49)

Indeed, we are encouraged to look toward BCT as a very supportive tool in solving the main problem arising at almost al levels of our world: ***decision***. What is a ***blockchain***, BC?

> *Here is my best attempt (for now): A Blockchain is a huge file which stores data in a logical, historical, secure, and immutable way.* (see [11], pp. 136-137)

The basic components of a BC are:

- **transactions**: operations that transfer, or change, the value of tangible or intangible assets between different parties using a *pair-to pair* mechanism

- **blocks**: are entities linked to each other, like a chain, because every block contains a reference to the previous block.

There are three actors on a BC:

- **users**: they have two, mathematically linked, keys, not one; the *private* one (used to access the box) and the *public* one (your own identity, address on the BC)

- **nodes**: are all the computers connected to the network that can read and write from a BC; they are always connected and in sync with the network and, crucially, must have a full copy of all the transactions that have ever happened

- **miners**: are nodes that are allowed to add a block onto the BC by competing to solve a special mathematical problem, which has as variable the latest state of the BC.

> *A voting system on a Blockchain? Unmatched electoral transparency? Accountability for the decisions of the politicians who represent us? More and more countries are already experimenting with e-voting systems, some of them on a Blockchain. Here is an example:* `https://followmyvote.com`. (see [11], pp. 410-413)

BCT allows transactions in a completely transparent manner. There is no mediator in between two entities making a transaction, and the entire process is easier and cheaper. This concept can be applied to the entire digital world.

Two integrated networks will emerge. First, like-minded people will be able to collaborate in order to affect legislation. Secondly, voters will be integrated with all levels of the system. The fact that votes can be traded with those who can make better decisions is both a plus and a possible minus. On one hand, professionals will be able to make weighted decisions. But, on the other hand, it is possible that votes can be consolidated in the hands of a limited group. As we learned in the millennial history of technology, any technology has its *pros & cons*.

4. Architecture of the decision technology

The confidence provided by the use of BCT in a very sensitive domain as the financial one, allow us to propose a *bitCoin*-like environment for the voting mechanism. Two mechanisms are described in the following. The first mimic the current voting process for electing a candidate out of many. The second tries to present a more complex process of a multi-dimension decision allowed by the enlarged possibilities ITs offer.

4.1. Blockchain-Based Vote

Although there is a common misconception that voting cannot be done online in a secure way, there are increasing examples of political organizations experimenting with secure digital voting systems based on the use of BCT [12]. The transactional mechanism which sends the digital currency to the recipients digital wallet can be used by creating wallets for each option submitted to vote. All voters are allocated a ***voteCoin*** that represents one vote, which they can cast by sending it to the wallet of their choice. As in any *cryptoCoin* transaction, the voting process is recorded in a BC public ledger, such that a voter can verify that her or his vote was correctly counted.

Initially, each of the K voters has in its "voter wallet" one *voteCoin*, $VW_i = 1$ for $i = 1,\ldots,K$, and all N "option wallets" are empty, $OW_j = 0$ for $j = 1,\ldots,N$.

When the vote is completed: $OW_j = v_j$ for $j = 1,\ldots,N$, with $\sum_{j=1}^{N} v_j \leq K$.

This vote allows also an easy exercise of the *liquid democracy* [13]. Indeed, any voter, let us say John, can send its *voteCoin* in the "vote wallet" of Bob, an acquaintance of trust. It happens when John considers that Bob is better qualified to make the best selection.

4.2. Weighted iVote

A preliminary, version of this type of iVote is presented in the following. To keep the story short, each decision D has m articles (a more complex approach must support decision with articles detailed to sub-articles, and so on) organized in a list of lists, as follows:

$$D = ((A_1),\ldots,(A_m))$$

where: A_i, for $i = 1,\ldots,m$, is a text.

To take a decision in a voting space, a number of n attributes to be fulfilled by each voter are defined. For each article associated to a vote the weight of each attribute is instantiated

specifically. The number of attributes depends on the how complex is considered the voting space.

Thus, for each article to be voted is instantiated the one-dimension array of *requested competencies*:

$$R_i = [r_{i1}, r_{i2}, \ldots, r_{in}]$$

where $r_{ij} \in [0,1]$ or $r_{ij} \in \{0,1\}$ is the weight of the competence for the attribute j, for $j = 1, \ldots, n$, in the decision about the article i, for $i = 1, \ldots, m$.

Each voter V^k, out of the K voters, is defined by a one-dimension array of *possessed competencies*:

$$P_k = [p_1, p_2, \ldots, p_n]$$

where $p_i \in [0,1]$ or $p_i \in \{0,1\}$ is the degree of competence for the attribute j the voter k possesses, for $j = 1, \ldots, n$, in any decision to be taken. The one-dimension array P_k can be seen as a "personal avatar" that the owner has under his responsible control.

The selection between $\in [0,1]$ or $\in \{0,1\}$, in defining the weight domain as a continuous domain or a discrete one, provides four approaches depending on the accuracy requested for the decision process.

A cycle in the voting process starts with the instantiation of the matrix of competencies requested for the m-article decision D:

$$\mathbf{R}(D) = \begin{bmatrix} r_{11} & r_{12} & \ldots & r_{1n} \\ r_{21} & r_{22} & \ldots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \ldots & r_{mn} \end{bmatrix}$$

Then the matrix **R**(D) is transformed in the weighted matrix **R'**, according to the number and size of the non-zero components on each line:

$$\mathbf{R}'(D) = \begin{bmatrix} r'_{11} & r'_{12} & \ldots & r'_{1n} \\ r'_{21} & r'_{22} & \ldots & r'_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r'_{m1} & r'_{m2} & \ldots & r'_{mn} \end{bmatrix}$$

where:

$$r'_{ij} = \frac{r_{ij}}{\sum_{j=1}^{n} r_{ij}}$$

Each voter receives the matrix **R'**(D) and m *voteCoins* in its *wallet* [12], one for each article of the decision D. Each voter computes the product between the matrix **R'**(D) and the transposed array P_k:

$$C^k = \mathbf{R}(D) \times P_k^T = [v_1^k, \ldots, v_m^k]$$

which represents the m-component one-dimension array of competencies of the voter k regarding the m articles of the decision D. For the most competent voter regarding the decision D results: $C^k = [1,1,\ldots,1]$, while for the most incompetent voter results: $C^k = [0,0,\ldots,0]$.

Now the voter expresses its opinion regarding the m articles in three one-dimension arrays:

$$O^+ = [o_1^+, \ldots, o_m^+]$$

$$O^- = [o_1^-, \ldots, o_m^-]$$

$$O^0 = [o_1^0, \ldots, o_m^0]$$

in which distributes the *m voteCoins* as 1s to indicate where the voter agrees, in vector O^+, disagree, in vector O^-, or is undecided, in vector O^0. For example, if the voter agrees with article A_i, then $\langle o_i^+ \; o_i^- \; o_i^0 \rangle = \langle 1 \; 0 \; 0 \rangle$, if she/hi does not agree, then $\langle o_i^+ \; o_i^- \; o_i^0 \rangle = \langle 0 \; 1 \; 0 \rangle$, else $\langle o_i^+ \; o_i^- \; o_i^0 \rangle = \langle 0 \; 0 \; 1 \rangle$.

Then the vote is transmitted to the destination wallet *anonymously*, as three *m*-size *voteArrays* computed using the anonymous form of C^k

$$C = [v_1, \ldots, v_m]$$

as follow:

$$V^+ = O^+ \times C = [v_1 \times o_1^+, \ldots, v_m \times o_m^+]$$

$$V^- = O^- \times C = [v_1 \times o_1^-, \ldots, v_m \times o_m^-]$$

$$V^0 = O^+ \times C = [v_1 \times o_1^0, \ldots, v_m \times o_m^0]$$

To the destination wallet are sent the previous three vectors as a $3 \times m$ matrix, $\mathbf{O}$, in order to provide a detailed opinion of the voter regarding the issue submitted to vote. In the destination wallet, the matrices $\mathbf{O}$ received from the voters are added and the resulting matrix:

$$\Omega(D) = \begin{bmatrix} \omega_{+1} & \omega_{+2} & \ldots & \omega_{+m} \\ \omega_{-1} & \omega_{-2} & \ldots & \omega_{-m} \\ \omega_{01} & \omega_{02} & \ldots & \omega_{0m} \end{bmatrix}$$

is the final result of vote on D. In this form the vote can be interpreted and used in modes inconceivable using standard, XVIII-th century "vote technologies". For example, the degree of confidence in the vote can be computed as

$$\gamma(D) = \frac{\sum_{i=1}^{m} \omega_{+i} + \sum_{i=1}^{m} \omega_{-i}}{K \times m}$$

where K is the number of voters. We interpret $\gamma(D)$ as the weight of the competence in the pool of K voters regarding the decision on the issue D. Another example is:

$$\delta(D) = \frac{\sum_{i=1}^{m} \omega_{+i}}{K \times m}$$

which, if it is too big, then tells to the vote organizers that some of the articles submitted to vote are not enough clearly stated.

In the experimental stage of the system, sending the un-weighted vote, O^+, O^-, O^0, could be also very useful. With a small amount of additional computation a lot of meaningful information can be extracted comparing the "raw" opinion with the weighted opinion.

The approach can be refined using a more detailed analysis. For example, concepts like *group position*, *group intensity* or *group polarization*, introduced in [14], can be taken and adapted to our approach in order to deepen the understanding about the voting process.

5. iDemocracy

Many people claim: the only true democracy is the direct democracy, where people vote directly on all issues, not to elect the voters. There are already organized entities of the civil society promoting the idea of this kind of democracy. They claim:

> *We are musicians, producers, artists and political activists [not politicians] who have registered our movement [the People's Administration] as a mainstream political party with the Electoral Commission [March 2010] so as to create the opportunity to legitimately implement a reform to direct democracy in the UK using the web and telephone.* [15]

Because, politicians are not problem solvers (they are generally low level performers from media or from the law system), it is engineers, scientists, philosophers, artists, teachers, analysts, ... who are natural problem solvers and, consequently the only persons to be directly involved in the democratic decision process. No centralised thinking and politics enable for more creative thought and creative solutions to be found for today's issues. With direct democracy, open or hidden organisations of any nature can not manipulate the power any longer, as the power will be with every individual. With BCT, a voter will be able to check if her/his vote was sent correctly, while keeping the voter's name unknown to everybody else [16].

The use of BC based iVote is easier than using it in a *cryptoCoin* application, because scalability presents a bound that will be difficult to pass in terms of BC applicability in the financial sector, but the same issue doest necessarily exist in operations where the BC has a fixed size that it will eventually reach [17].

In an iDemocratic system the voting mechanism previously described can be used for decisions at any level in society. It is almost clear that the existence of the political class becomes questionable with a well designed and used iVote.

However, the iDemocratic approach based on iVote is not always a good solution provider. If coefficients like γ, δ , and others the like, provide low confidence in the iVote result, then we must look for additional mechanisms. Even with the help of iDemocracy, democracy remains a political Utopia.

6. iConsensus through iiVote

The flexibility offered by ITs to iVote encourages us the use the iVote mechanism in a more complex way. Let us improve the iVote with two additional features:

- the iteration mechanism, which allow multiple iteration on the same D, until the confidence score γ is high enough
- the comment mechanism, which provides to each voter the possibility make comments on the articles A_i of D

and call it *iterative iVote*, ***iiVote***.

To allow iterative comments, the structure of D must be improved in order to simplify the processing of the comments made by the voters at each iteration. One example, among many others, of how to structure the D list is:

$$D = ((A_1(P_1)(K_1)) \dots (A_m(P_m)(K_m)))$$

where each article A_i is accompanied by other two lists:

- (P_i): the list of parameters used in A_i
- (K_i): the list of key words (short meaningful sentences are allowed) used in A_i

This form of D list allow the building of the commented D list, of form:

$$D_C = (((P'_1)(K'_1)) \dots ((P'_m)(K'_m)))$$

by modifying partially or totaly the parameters or the key words. To each instance of D, D^J, each voter can provide a D^J_C.

Then, we propose *iiVote* to be carried out in the following way:

step 0 : the first version, D^0, of the proposed decision is stated

step 1 : the current version of D, D^j for $j = 0, 1, \dots$, is issued to the voters by the vote organizers, ORG

step 2 : each voter sends back to ORG its vote, accompanied by its commentary, D^j_C

step 3 : the vote is evaluated by ORG

- **if** the various meaningful scores (like γ, δ, or others) are satisfactory, **then** process **ends**
- **else**
  - the vote is analyzed using $\Omega(D^j)$ and the K comments, D^j_C, provided by the voters
  - the proposal is reformulated: $D^j \to D^{j+1}$
  - the process is resumed form **step 1**

If after a reasonable number of cycles the *iiVote* ends, then it is possible to say the voters reached a consensus. Thus, from iDemocracy emerges iConsensus. But, this is not always the case. First of all, depends on what means "satisfactory" in **step 3** of the previous algorithm. But, more important, the iterative loop is not always convergent; for some situations some important scores start to oscillate far from the desired values. This will be maybe the case for complex decisions with big m and too strong interrelations between the content (expressed synthetical by the content of the lists (P_i) and (K_i)) of various A_is.

What we expect, from a iDemocratic approach and a possible iConsensus achievement, is the equality of participation, and the involvement of each of us in the public affairs. Distributed consensus rather than chaotic and competitive interconnection becomes possible. The decision is the most specific human behavior and its effective practice provides the biggest reward we can receive from our involvement in community live. Unfortunately, sometimes the complexity and the dynamic of the world exceeds our ability, as individuals and as community too, to provide convergent solutions. Then the help must come from some tools able to manage in real time the complexity and the dynamics of the processes we deal with. These tools constitute what we started to designate by iGovernance.

7. iGovernance

> *We need regulations that act like technology – humble, experimental, and iterative.*
>
> Don Tapscott & Alex Tapscott [2]

While regulation is about law design, using an iDemocratic or an iConsensual mechanism, governance is about stewardship, collaboration, and incentives to act on common interests. The state and the associated law system can be a rational construct very well formalized. The main problem occurs when this rational construct is used by its human beneficiary. As beings, we are only partially rational. Thus, the overall system – the state, its formal settlement and the human stewards – becomes "less rational". Any well formalized system can be distorted by an unappropriate use. Then, it is not enough to have good rules. The good use of them by the government is mandatory too. The emergent ITs could help in this respect.

Firstly, the openness, based on the distributed ledgers provided by the BCT, are able to well temper the fraudulent tendencies of a corrupt administration.

Secondly, iDemocratic or iConsensual decision mechanism generate the condition for a leaderless democracy: ***only administrators, no politicians***.

Thirdly, the current explosive development of artificial intelligence, AI, provides that incontestable (***sacred!?***) entity able to apply rigorously the forms established through an iDemocratic or iConsensual decision mechanism.

The dilemma *"more* **or** *less governance"* receives an unexpected solution: more AI-based governance **and** less human-based governance. The process of regulation in the complex context of our world, supported by AI techniques, can be freed from ideologically motivated interferences or group interests. Just as autonomous cars, once left alone on a road free of human drivers, will reduce the accident rate, so AI-based administration will reduce the current dysfunctional bureaucratic practices.

8. Concluding remarks

Despite of many voices advocating against the new ITs, AI-based mainly, we can be optimistic. We know, any technology cames with a price, but, in the same time it comes with progress. It is our job to promote those applications leading to progress. A well guided governance – AI-based iGovernance – is supposed to help in this process.

> *Ultimately, a blockchain governance network should strive to be inclusive and welcome participation from all relevant stakeholder groups. The network should be a meritocracy, meaning that the community would champion viable proposals regardless of the rank and status of the proposer. The network should be transparent, releasing all of its data, documentation, and meeting minutes for public scrutiny. Finally, decision should be reached, as much as possible, by consensus in order to gain legitimacy for the outcomes.* ([2] p. 307)

The path from the actual corrupt Democracy to AI-based iGovernance is a gradual process passing through the challenging stages of iDemocracy and iConsensus. Who is in charge in leading this evolution? For sure, not the actual political class. Maybe the civil society will take eventually the leadership. This is a hope hard to fulfill. There is another chance: the self-organizing instinct of the human beings.

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