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Future living framework: Is blockchain the next enabling network?

Maria-Lluïsa Marsal-Llacuna

Universitat Pompeu Fabra, ICT Engineering Department, Tànger 122-140, 08018 Barcelona, Spain

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ABSTRACT

Blockchain is not the first -and certainly will not be the last- network fever we will experience. This paper shows how blockchain networks will disrupt the urban context as well, similarly to what it is happening in the *fintech* and *insurtech* spaces, among many other emerging application domains. We put forward the Future Living Framework as the meta use case of a wider research called Blockchain4Cities. In this use case, which uses UN's New Urban Agenda (NUA) as exemplifying model, we show the benefits of using blockchain in the urban field and we do so by breaking down the NUA in policies, planning, regulations and standards and dissecting these further into Quito's Implementation Plan (QIP) themes and scopes. Use case results confirm that blockchain will disrupt urban networks, like Cybernetics did in 1948, Ekistics a decade later, and the Metabolists and Webbists in the late sixties. The Ubiquitous Computing arrived later, in the seventies, and disrupted all the previous network efforts, lasting until the current Internet of Things (IoT) and its sister concept Smart Cities, when IoT is used in an urban context. Blockchain is here to take on and be the next network for cities.

1. Do we need new urban networks?

Our urban codes (policies, planning, regulations and standards) are not succeeding in tackling our current urban challenges since they haven't been meeting today's sustainability requirements and goals.

Let's analyse first Environmental Sustainability. With all environmental regulation and rule of law in place -at both national and international levels-, and stacks of technology supporting these (electric cars, solar panels, CO_2 accountability systems, etc.) we should have the cleanest air ever! Unfortunately, just to give an example, some cities in Asia are recording the highest pollution levels of their history.

On the Social aspect of Sustainability, how is it possible that, after all international agreements, treaties, charters, and many other codes meant to support Social Sustainability, we, humans, instead of building the greatest urban settlements ever we are destroying our best cities? Think of cities in Syria as an example. And, it is not only that these current societal codes fail, we have great social technological tools but we are not using their possibilities in the most helpful way. I wonder, are social media apps mostly used to help and empower integration, equality, acceptance, tolerance, justice, etc. I guess not.

The big one is Economic Sustainability. So many trade deals, employment programmes, financial agreements, entrepreneurship schemes, etc., lots of economic conventions made available for our societies to have good economic performance. But it is not only that some countries are recording their highest unemployment rates, also their worse homeless figures ever. Some blame the technology for this, arguing that current automation triggers an unprecedented 'middleman crises' which is causing unskilled people to lose their jobs. No, the technology is not the cause of our poor economic performance. Technology definitively empowers people since new skills are in continuous demand and therefore traditional professions have the opportunity to be reengineered and thus new jobs are created.

Then, if it is not the technology, do we have to blame the codes? Our current codes (including urban codes) are still a legacy of the first Babylonians. We are still using Hammurabi's top-down approach to governance and giving power to centralised authorities to make sure the status quo is not disrupted. It is not the code itself what needs to be reimagined, but its delivery network. And since the existence of virtual networks, codes' delivery networks consist of both physical and virtual networks.

Physical and virtual networks had and still have a romance. Specifically to the urban context this romance starts in the early sixties when Constantinos Doxiadis, together with a group of architects and telecommunication engineers including Buckminster Fuller (1963) and Mc Luhan (1962), created the Ekistics movement (Dioxadis, 1968) to study and anticipate the effects of what they foresaw as excessive growth of urban settlements, facilitated by what they called "network fever".

Thus, the Ekistics were the first to merge physical and virtual networks and understand the urban space as a combination of both. Ekistics sustained that the real dimension of cities was not space but time. Well known examples of this are Dioxadis's Chicago

E-mail address: lluisa.marsal@upf.edu.

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Transportation Study, the so called *Cartographatrons of Desire Lin*es, in 1959; the *Electromagnetic Maps of City Growth*, by Dioxadis in 1962; the *USA as Single City*, Dioxadis 1963. This *physicovirtual* network fervour became clear in the *City of the Future* project that Doxiadis launched in 1960 and kept working on it until his death. The *City of the Future* predicts the emergence of a single city covering the whole earth like a lava lamp network, a biomorphic growth extending itself everywhere (Wigley, 2001).

The Ekistics movement was continued by the Metabolists (Renzo Tange, Arata Isozaki, Kisho Kurokawa are the well-known ones), and later the Neofuturists (Cedric Prize, the Archigram group, among others), which then were followed by the Webbists (mainly Khan and Tyng, Jackson Pollock, and Andre Waterkeyn) (Friedman, 1971, 1978). The architectural and urbanistic expressions of these avant-garde groups were physical representations of virtual networks and flows. The legacy of all these groups has been carried forward and reached us. The current combined expression of virtual and physical networks is in the so-called Internet of Things (IoT) where a network of devices physically located in the city are connected to the internet to report and monitor real time a specific urban or architectural aspect (Mehmood et al., 2017; Talari et al., 2017).

What all these expressions of combined physical and virtual networks have in common is the fact that the physical network is subsidiary to the virtual one. This is also becoming evident in futuristic expressions of the IoT, in the so-called Internet of Spaces (IoS) and the Internet of Places (IoP), both using sub-orbital-based high-data rate communication networks to organise and drive spaces and places (Brovelli et al., 2015; Lee, 2015). In other words, virtual networks have -and seems will continue having- control over the physical ones, letting the later at their mercy. Author's working hypothesis and for which this research is trying to find answers is that

> The control that virtual networks have over physical ones is what allows for today's monopolised and centralised delivery of codes

As mentioned earlier, this centralised delivery of codes is Hammurabi's legacy and the increasing use of on-line tools to deliver codes (the so-called e-governance) strengthens this since the internet is getting more centralised and -most concerningly- monopolised. As pointed out by Ibáñez et al. (2017) a few internet companies dominate the web space thanks to their de facto monopolistic position which does not promote equal use of the internet, being the cause of the *Tragedy of Commons*. Since these issues have been identified, many voices have been raised advocating for decentralisation and universality back to the web (Ibáñez et al., 2017).

This decentralised and universal internet is the blockchain, a disruptive form of transparent peer-to-peer transactions that provides equal access and use to everyone. As assumptions accompanying the hypothesis, the author sustains that

> The blockchain is the right network to succeed in the delivery of codes since it is universal and decentralised, allowing for a bottom-up delivery of codes owned and implemented by the citizen and not by a central authority.

Moreover, as shown in the following section, it is blockchain's decentralised and disruptive approach what will eradicate the subordination of physical networks to virtual ones thanks to its inherent coopetition networking environment. Next, section three tackles our sustainability challenges and unveils how blockchain's coopetitive environment, plus its immutable accountability capabilities will naturally empower and incentivise citizens to deliver codes as physical actions. Lastly, section four presents the example that uses the New Urban Agenda as a use case to prove sections' three arguments: it will be this a bottom-up implementation of economic, environmental and social codes and people's codes ownership what will make us succeed in tackling our essential global challenges.

2. Is blockchain the new network for our future living?

Internet is causing a massive digital transformation but with an undesirable centralisation effect caused by the monopolism of a few who become de facto central authorities because of their leadership in these digitalisation processes which, moreover, are delivered under a non-participatory manner and have questionable privacy formats. As a result of this, e-government efforts in promoting consultative and anonymous code-drafting exercises can be hurt or even undermined.

We have to go back to the technologies preceding the internet to find genuine examples of network universality and decentralisation. Actually, it will be the more 'primitive' human-machine communication principles of these older technologies what allows for a coopetitive space. In this section, after recalling on the original linkages between coopetition and decentralised network universality, we will suggest an answer to the working hypothesis that leverages on the blockchain to recover these linkages as the means to end with the dominance of virtual networks over the physical ones. Next, we will show that the assumption accompanying the hypothesis was correct since blockchain's virtual and physical networking symbiosis will allow the citizen to become an active code-maker instead of the code-receivers we are nowadays.

Current urban networks, the so-called Smart Cities run on the Internet of Things (IoT). IoT has its origins in Mark Weiser's (1991) modern Ubiquitous Computing, whose works build on Robert Pask's (1968) early Ubiquitous Computing who, in turn, essentially evolved Norbert Wiener's late Cybernetics theories (Wiener, 1948) by including what he called "the feedback principle" seeking a more *conversational* Cybernetics. Norbert Wiener is considered the father of Cybernetics since he elaborated the first cyber theories on how communication is established between the animal (Human) and the Machine (Wiener, 1948). In today's terminology, this is what we could call H2M (Human to Machine) communication.

In his main dissertation, *Cybernetics or Control and Communication in the Animal and the Machine* (1948), Wiener, besides pioneering a set of Human to Machine principles of interactive communication, he also uses for the first time the term "cybernetics" to qualify this interactive communication as a self-regulating mechanism, arguing that the machine adjusts its response to the feedback provided by the human and the human replies naturally to the oscillation of the machine. When this bidirectional communication occurs in a network, all H2M pairs are acknowledged equally since what is ruling the system is this auto-controlled back and forth interaction. It is exactly this equality between H2M pairs in the network what got lost in the evolution towards the internet.

As mentioned earlier, blockchain brings back not only decentralisation but universality, which means that all the nodes in the network are acknowledged equally and, consequently, the communication that nodes' peers (Humans) will establish with their computers (Machines) will be evenly considered by the network, without discriminations or privileges. Therefore, it can be asserted that a blockchain network is a cybernetic system in true Weiner's terms, whereas today's internet isn't because of its bias towards centralisation which results in different weight of nodes and, consequently, of their inputs in the network. Blockchain networks and any other Weiner-based peer-to-peer network are the environments where the so-called coopetition flourishes.

Coopetition is a largely studied subject and, as the same term describes, stands for "cooperative competition". Basic principles of coopetitive structures were first described in game theory, mainly by Von Neumann and Morgenstern in *Theory of Games and Economic Behavior* in 1944. In a Weiner-like humans and machines environment, coopetition is physical and will occur when the pair Human-Machine interacts with other pairs in the network with a partial confluence of interests. They will cooperate with each other to reach a higher value creation if compared to the value they would create without physical interaction.