Social Operative System (sOS): The Use of Technology to Develop New Forms of Governance

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Declaration: Although it draws upon the ideas and findings of other scholars, the present thesis represents an original work authored solely by myself. Except as specified in the text, it has not been previously submitted, either in part or in full, for any academic degree or diploma at the University of Barcelona or any other University. The research trajectory that follows this thesis began with my Sociology Final Dissertation Degree study, titled "Competitiveness and Cooperation in Social Innovation: A Frame Analysis, defining the vision and the approach of the Sociology master's degree Dissertation entitled "Social Big Data: Use of data technology for institutional design and civil society empowerment" (Huerva, 2018). The latter work serves as the foundation for the research presented in this dissertation and is implicit in this thesis.

Summary

Is governance a technology? How can we combine the different technological resources available today to design forms of governance under the new context and challenges that humanity must face? This thesis aims to explore this issue and proposes a novel approach to design forms of governance that are suited to the challenges of the contemporary world.

To address this question, the first chapter will outline the technical sections of the investigation and the perspective that will guide the analysis. This will define from the trajectory of governance and its current state to the exploration of potential solutions.

The second chapter will develop a comprehensive theoretical framework to support the thesis and argue the solution. This will encompass a wide range of topics, including the relationship between physical and social technologies, trajectories of power and governance, ways to measure the individual and society, or cybernetic systems. This chapter aims to provide a solid foundation for the proposed solution, which will be presented in the next chapter.

Drawing on the theoretical framework developed in the previous chapter, this thesis's third chapter proposes an emerging governance model. This model is analogous to an assembly of individuals who communicate through their artificial intelligence. It is designed to define new limits on the privacy and freedoms of individuals while enabling custom policy design for each individual and improving consensus through individual data.

The annexes of this work comprise the tests and the next steps of the proposed solution. These will outline the steps that need to be taken to refine and implement the model, as well as the future research directions that could be pursued.

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Glossary

AI: Artificial Intelligence.

API: Application Programming Interface.

BMR: Basal Metabolic Rate.

CAS: Complex Adaptative System.

CNNs: Convolutional Neural Networks.

CSR: Corporate Social Responsibility.

CUDO: Communism Universalism Disinterestedness Organized skepticism.

DAO: Decentralized Autonomous Organization.

DeFi: Decentralized Finance.

DLT: Distributed Ledger Technology.

EPP: Emergent Political Process.

EDA: Electro Dermal Activity.

GDP: Gross Domestic Product.

GDPR: General Data Protection Regulation.

GPT: Generative Pre-trained Transformer.

GST: General Systems Theory.

HiDAC: High-Density Autonomous Crowds.

ICO: Initial Coin Offering.

IF: Investment Fund.

IOs: International Organizations.

MACD: Moving Average Convergence Divergence.

MAL: Multi-Agent Learning.

MDF: Multi Division Form.

MGSD: Matrix Game Social Dilemmas.

ML: Machine Learning.

MMC: Mass Media Communication.

NFT: Non-Fungible Token.

NLP: Neural Language Processing

OCEAN: Openness Consciousness Extroversion Agreeableness Neuroticism.

OSINT: Open-Source Intelligence.

PoS: Proof of Stake.

PoW: Proof of Work.

PoY: Proof of You.

P2P: Peer-to-peer.

RSI: Relative Strength Index.

SDG: Sustainable Development Goal.

SICAV: Société d'Investissement à Capital Variable.

SOS: Social Operative System.

SSD: Sequential Social Dilemmas.

STEM: Science Technology Engineering Mathematics.

TPS: Transactions Per Second.

WS: Welfare State.

WTO: World Trade Organization.

Chapter I

1 Introduction

Following the working process of the *Progress Towards the Sustainable Development Goals: Towards a Rescue Plan for People and Planet* report (UN, 2023), in response to the General Assembly resolution 70/1, *Transforming Our World: the 2030 Agenda for Sustainable Development* (UN, 2015), society has many challenges and not much time to act. Based on the assessed targets scheme in that report (Fig. 1), some Sustainable Development Goals (SDG) such as Peace, Justice, and Strong Institutions (SDG 16), Climate Action (SDG 13), or Decent Work and Economic Growth (SDG 8) on track progress line is inexistent. Others like Reduced Inequalities (SDG 10), life below water (SDG 14), stagnation, or regression are prominent versus on-track progress. Building and using a car can have a significant environmental impact and deplete resources in our finite world; however, the automotive industry is a pillar of current economies (Sperling & Gordon, 2009; Heinberg & Fridley, 2016). The automotive industry is just an example; it can be seen in other industries like fashion, electronics, tourism or food. Responsible consumption and production (SDG 12) involve new habits incompatible with the current economic growth models. Are societies resilient to new paradigms (SDG 11)? Do we need to mine resources from the bottom of the sea? Can we do it without endangering SDG 14? Can we define new ways of peace, justice, and strong institutions (SDG 16) in a world where war is and has been a prominent economic industry?

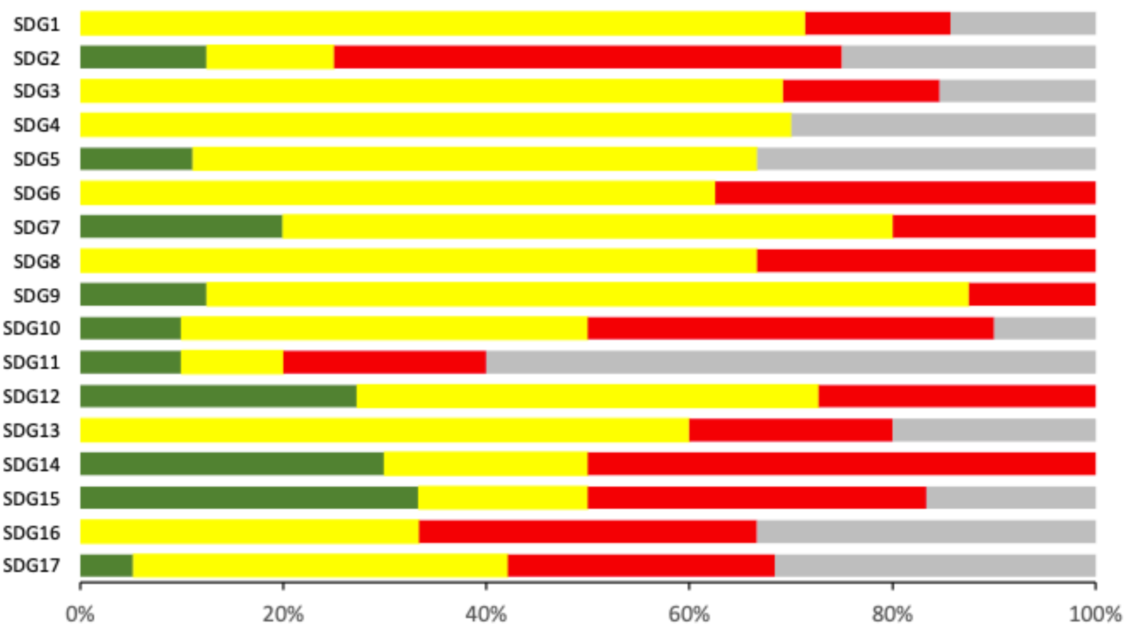

Figure 1. Share of targets assessed. Green shows on track or target met, in yellow fair progress but acceleration needed, and in red, stagnation or regression; finally, grey color shows insufficient data. Source (UN, 2023).

In a world managed in the best case as a democracy controlled less by oligarchies and interest parties, and in the worst managed as a chiefly or kingdom dictatorship, it can be difficult not only to achieve SDG 16 but also the 2030 Goals. The researcher believes that all the SDGs are interconnected because they address the same underlying problem: a problem of social organization about how we organize ourselves as individuals and as a society according to what surrounds us and what we interpret about what surrounds us. Achieving UN objectives requires a transformation in all aspects of society and a shift in how society is managed.

Human beings and societies are changing; societies have trajectories and different ways to organize themselves according to social, physical, and individual information (context). The analysis of trajectories along history shows strategies, or behaviors, to manage complexity, information, and contexts. Societies manage complexity, and societies can better overcome complexity than just one individual. However, there is some point where more complexity overcomes society, when the ways of managing (organizing) society do not correspond to the complexity. The research also considers that the way to manage complexity requires complexity; however, human beings have an ally to manage complexity: technology.

The researcher considers that societies today face unprecedented levels of complexity in social, individual, and physical domains, and the current forms of organization and management are inadequate to deal with them. The researcher initially hypothesizes that this is because the current methods of managing complexity are based on outdated models developed in the 18th and 19th centuries, based on powers that are no longer sufficient to handle the new complexities of the modern world. After defining technologies as the physical and social tools to control the physical and social contexts, the researcher considers that current structures that organize society could also be explained through technologies and the power dimension (Frey, 2019), configuring trajectories of more complexity and social emancipation. But perhaps centralized architectures related to power structures are the main reason for not reaching higher levels of complexity; perhaps centralized structures can only manage certain complexity.

The researcher considers that new structures and technologies must be developed to embrace and manage the increased complexity levels characteristic of contemporary societies. To accomplish this, it analyzes the elements that affect the organization of complexity and devises forms of complex social organization to encompass greater complexity.

The management of complexity within society is a multifaceted issue. Technology plays a crucial role in organizing and managing complexity; therefore, it is essential to understand the relationship between technology and complexity. Herbert Simon (Simon, 1962) argued that technology has the capacity to manage complex problems, including those faced by society. This argument highlights the critical role of technology in managing complexity. Furthermore, (Brynjolfsson & McAfee, 2014) proposed that technology is increasing exponentially, linked to the growth of complexity within society. They suggest that the relationship between technology and complexity follows a logarithmic progression. This indicates that societies nowadays must face new challenges and complexities and that we have the technological tools to develop solutions to manage society according to current individual, social, and physical complexity. But how do we accomplish this? The research initially seeks ways to manage complexity for sustainable development (Hedelin, 2019), but the researcher needs to define a more specific approach and execution; the starting point of managing complexity is to manage energy, and as Shannon stated, information is energy (Shannon, 1959); so, information and data management is a crucial point that is present throughout this dissertation.

In 1812, Pierre Simon Laplace wrote *Theorie Analytique des Probabilites*, and this thesis takes inspiration from Laplace's "intellect" concept (or "demon" in the English version), which posits that "an intellect with complete knowledge of all forces that set nature in motion, as well as all positions of all items of which nature is composed, could use such data to predict the movements of the greatest bodies of the universe and those of the tiniest atom within a single formula" (Laplace, 1951). This concept presents determinism (Hawking, 1999) and confronts Thermodynamics and Chaos Theories. Although prediction involves determinism, humans are not deterministic and can trace trajectories. However, despite seeming paradoxical, human actions can still be forecasted in the short term (Rovira et al., 2017). Social systems are in the domain of Complexity Theories, with Chaos Theories being crucial (Gleick, 1987). Measuring chaos and forecasting it has proven challenging (Lorenz, 1963), including for supercomputers as the uncertainty increases with each day added to the forecast.

Nonetheless, more information can lead to better predictions. It is essential to contextualize Laplace's concept within 18th-century positivism and the emergence of the "superhuman" ideals. The idea of an "intellect" that can compute all information to understand the universe's context and make decisions was advanced for its time, perhaps at that time as an exercise to describe God. Nowadays, this idea is becoming more feasible (Bostrom, 2016). Laplace's "intellect" follows a singleton conception, like a God or an oracle, a "supreme" entity that understands because it has "complete" information. However, as Bostrom states, a singleton is perverse; the researcher considers alternative ways to achieve this "intellect" to help us organize complexity. A collective intellect maybe could provide better possibilities, especially when emergent systems are analyzed.

Defining new *tools* to manage further complexity is a challenge, especially because one needs to examine the current situation from multiple perspectives and determine approaches to measure society as a complex system. Interdependencies have a crucial role in the research, relating the control of interdependencies to control complexity, but how do we measure them? How do we measure synergies for example? Can we only control the interdependencies by means of economic metrics?

The researcher has been inspired by the imaginative relationship between societies and the Mandelbrot set; the Mandelbrot set expresses logistic map equation, exponentiality, complexity, and chaos, is based on similarities with locality dynamics, and shows that the tiny structures become big structures (non-linearity). The researcher considers the hologrammatic and recursive principles (Morin & Pakman, 1994) embedded in the Mandelbrot set, and even if the Mandelbrot set is universal (McMullen, 2000), the researcher cannot define or affirm this relationship with society, it is just an inspiration.

2 Objectives

Based on what is seen, the main goal is to find a way to organize complexity better. How can we organize ourselves better for the new challenges humanity must face? How can we use current technologies to define better forms of governance? The main goal is to conceptualize a governance framework that can foster progress and resilience; and respond to the new complexities and challenges humanity faces through diversity and individual projection through equality and consensus. This involves:

- Discover novel ways of individual and social empowerment through data processing technologies.
- Find new forms of social consensus to minimize conflict and promote social progress using individual data.
- Identify ways to minimize conflict during technological transitions.
- Establish foundations for the scientific and social applications of this research.
- Develop a regulatory framework to build a form of decentralized governance.

3 Scientific Orientation

The scientific approach to research, emphasizing science's societal impact, traces back to Desmond Bernal's The Social Function of Science (Bernal, 1938). Bernal argued that science must serve society and that scientists must work to improve society. This dissertation aligns with Bernal's vision of using science as a means to improve society.

In addition, the research follows Merton's four scientific standards (Merton, 1973): Communism, Universalism, Disinterest, and Organized Skepticism (CUDO). This work has been developed to maintain these premises and seek to offer technological tools from science to society for its empowerment, control of complexity, and progress. This thesis includes the design and execution plan of a social organization model that arises from ethical science principles. Also, various interests try to seize technological knowledge only for their own benefit, so the scientist must be able to ensure that his knowledge is not exclusive to some to the detriment of the rest but belongs to all (Krige & Barth, 2006).

The scientific orientation comprises:

1) Communism is about the distribution and ownership of knowledge, mathematics is not the property of one; it is the property of all. This research proposes to apply a method for organizing and developing science using a Decentralized Autonomous Organization (DAO), considered the best way to adhere to this principle. The practical application of this work (sOS) has also been registered under a Creative Commons license (socialbigdata.io).
2) Universalism separates ideology from science. A political ideology does not orient this research; it is oriented toward science and the benefit of society. It is oriented towards universality and universal application, which is why research has also developed its applicability, seeking a way to directly apply the entire investigation to society through a social technology that all individuals can use.
3) Disinterest, there is no economic or political interest according to the researcher's interests; in this work, there is an interest in science, the closest approximation to truth and knowledge. Throughout the investigation, the possibility of being able to sell the product of this research to corporate parties arose, which could deviate from the established objectives. When looking for forms of financing to carry out this research, it has been found that it could only be financed by supranational, governmental institutions, or orient this work as a product, to be sold and thus be financed by investment funds or venture capitalists. As seen later, the research considers that economic freedom equals freedom of governance, so it has devised a possible route to alternative financing (see the application section). The applicability of the investigation, although it requires three actors: supranational, corporate, and civil society, however, starts from civil society. It is bottom-up or bottom-to-bottom, where technology gives new tools that favor social empowerment to individuals.
4) The previous point leads to consistency with the principles that govern the dissertation and its implications since there are currently other ways to finance and execute science. It is also necessary to be consistent in that if the research deals in one part with the relationship between technologies and economic, political, and social empowerment; and that these allow the emancipation and progress of the individual, then the investigation must be consistent with itself, demonstrate it, and find the way to be able to prove that it can be sustained itself financially and to be able to lay the foundations of a form of self-management.
5) Research is oriented where the scientist is an entrepreneur (Wiener, 1950), applies theory to practice, and has the will to apply science to society directly. Debate and dissemination are pillars of science so that it can grow, generating opportunities to be applied to the community. However, the execution of science usually runs outside the framework in which science has been created; the execution typically goes through other agents with different interests and premises, probably economics, that interfere. The application of

science to improve society is intrinsically motivated because the researcher is a sociologist.

6) Skepticism is a premise present from the beginning of the investigation and part of self-criticism. An element that has been useful for questioning and generating antitheses but, on the other hand, has slowed down the entire process, reaching the point where excessive doubt and criticism may have led to stagnation.
7) The scientific orientation of the investigation distinguishes from a human conception as an economic, rational, productive entity in search of the maximum benefit. Up to a human conception from existentialist psychology, irrational, without a single rationality, which interprets and has motivations other than economic ones. The researcher considers that both express the same, although from different perspectives and contexts, because human beings are diverse.
8) If skepticism is essential to this dissertation, it is because utopia drives the work. In this sense, it is worth noting the influence of the work of Erik Olin Wright in Envisioning Real Utopias (Wright, 2010). Where imagination plays an important role, not only in imagining a better world but also in imagining how to make that world better. An initial reflection that considers the research is that today we can live in a utopia from the eyes of someone from the Middle Ages. However dystopian today's society may seem. The great challenge of utopia is to execute it, to make it a reality, which drives this work's practical vision and applicability.
9) Reading Global Power Knowledge, Science and Technology in International Affairs (Krige & Barth, 2006) has not only been used to better understand science and technology as strategic power tools for States. Nevertheless, to get to know the Scientific Internationalism movement, where technology gives stability to human beings, both economically and socially, shows technology as a vector of progress, not for nations but for humanity. It should be noted, as these authors affirm, based on the historical trajectory, that the relationship between science and nations "are not good friends" (Ibid.); science is universal, and nationalism is local. This relates to Prometheus Unleashed, where science is a diplomatic weapon (Doel & Harper, 2006).

Finally, it should be noted that the scientific will of the researcher seeks to get closer to the truth, an explanation of the facts or a theoretical conjunction that does not reflect the reality is of no use to him it would be like self-deception.

3.1 Technological Humanism

The term "technological humanism" has been found several times throughout the investigation, with Barcelona positioned as its capital. Technological humanism aims to reduce social inequalities (Medida de Gobierno, 2020) and aligns with the 2030 sustainable development goals. It is presented as the ethical vector that guides technological thinking, seeking a) social and environmental sustainability, b) social and individual empowerment, and c) a balance between privacy and the projection of individual liberties. The model developed in the research is centered on technology and human beings, opening doors to science and progress, both individually and collectively. This is why the model designed in the research aligns with the leitmotif of this thought.

4 Argumentation of the Categories of Analysis and Research Questions

To achieve the goals, the research questions are grouped into five analysis categories, and regardless of whether the work runs between different research designs, the overall orientation is primarily exploratory. Exploration helps to describe, create, and execute. In such a way, some questions lead to others, and thus, they define the path of the investigation. The various methods or approaches give the reason for this questioning process to achieve the objectives that follow this investigation. The direction of the research will depend on the answers obtained from the questions. This highlights the importance of asking the right questions. Without the correct questions, there are no correct answers, and without the correct answers, the exploration becomes meaningless. The research process requires reflection because a wrong inference in one answer can distort all subsequent questions and answers. When something appears not to fit, the researcher must go back and identify where the error occurred. This dissertation examines the same concepts from different perspectives, theories, and disciplines to ensure that their relationships are maintained and coherent. The questions asked during the investigation aim to understand trajectories, the current situation, available options, and how to execute the theoretical model.

This research can be divided into five categories of analysis, which differentiate the questions asked as a whole:

A) Category of analysis: Trajectories and Context

This category aims to define the current situation and its trajectory. The work starts from objectives, from an end, but the starting point must be well-known to trace the course to the goals. The responses of the first category create a course that defines the pillars of the thesis and refers to the forms of social organization and their relationships with the physical and social contexts. The relationship between technology and society and the justification of the research responds explicitly to the question: Can technology improve the forms of social organization and enhance its relationship with the physical and social ecosystems? Is there a way? There are many? Is it deterministic? At the moment in which it is appreciated that a path exists, the investigation looks for the elements that define this path.

A1A Why do we organize? A2A What are the forms of organization and their interaction in the context? A3A Is self-organization a utopia or a path? A4A Why is self-organization spontaneous? A5A How does the power vector affect this path?
A1B What is the relationship between technology and society? A2B What is the relationship between technology and forms of organization? A3B What is the relationship between technology and social innovation? A4B Can a comparison be made between physical tools and social tools? A5B Are there "social technologies"?
A1C If there are better technologies for physical technologies, are there better technologies for a social organization? A2C Is there a way? Or is there a cyclical process? Is there determinism? Can we organize ourselves better? A3C What are the elements that make an emancipatory technology?
A1D How is the current situation defined? A2D What is the underlying problem that it raises? A3D Is the current model sustainable? A4D Can technology improve forms of sustainability of the organization in the face of sudden contextual changes and continue to allow the trajectory of progress?
A1E What is progress?
A1F What is beyond liberalism, socialism, markets, and States? Are they final forms?

B) Category of Analysis: Data and Technologies

The second analytics category refers to data and associated technologies such as AI. The questions are oriented to using data for better benefit, social empowerment, and the forms of organization through them.
B1A What is the current data situation? B2A What are the problems and conflicts of data? B3A Can a relational schema be created for data that shows a person's identity? B4A What elements provide information about social behavior?
B1B How do we measure society? B2B How complexity is measured -> how society is measured.
B1C What information can be obtained through the smart devices that individuals have? B2B What aggregate (social) data is generated with the interaction of these devices?
B1D Is there a global strategy for the use of data? B2D What regulations are the data subscribed to?
B1E Can society find ways to control the data? B2E What does data empowerment allow? B3E How can society be empowered through data?
B1F Can data help us to make better decisions? B2F To find a better consensus? B3F To define better policies? B4F How can the use of AI techniques improve society?

C) Category of Analysis: Control and Management

The third category focuses on the questions to answer the exploration of decentralized forms, open forms of government, and forms of self-government. Since the category of analysis

refers to the data and the AI techniques that the investigation raises, several conflicts arise regarding privacy, control, interests, property, or consensus for decision-making.
C1A How can a social organization based on scientific principles be designed as self-organized?
C2A How can decentralized institutions improve democratic processes, diversity, and consensus for decision-making? C3A Can current technologies enhance sustainable self-organized forms of governance?

D) Category of Analysis: Model Definition

The fourth category refers to combining the different responses and designing the model. The questions refer to the dynamics, sustainability, bureaucratic forms, and transferability.
D1A When is a centralized institution more efficient and effective in a particular context, and when is a decentralized one? D2A How can a decentralized institution empower citizens? D3A How does a decentralized institution become dynamic, and what incentives does it need? D4A How are policies or consensus designed in a decentralized model? D5A: How can the linear bureaucratic model be extrapolated to a decentralized, non-linear one? D6A How can a transition between centralized and decentralized be managed? D7A What tools are needed? D8A How to convert a non-emergent system to an emergent system? D9A How.

E) Category of analysis: Application

The fifth category refers to the application of the model; the questions seek the best way to apply the model. They refer to legal and regulatory aspects, development, and the model's first tests.
E1A Top-down, bottom-up, bottom-bottom? What is the best strategy to embrace complexity? E2A Are emergent systems bottom-to-bottom? E3A Are human systems bottom-up or top-down? E4A What are the main impediments to self-governance? E3A How can the model be tested?

5 Research Design and Methodology

The work has mainly two methodological perspectives to cover the research field: The first is the traditional method, described by Descartes, where a set to be analyzed is divided according to a criterion, and each subset is analyzed, and each subgroup is divided into more subsets (Morin, 1994). It is a specialized analysis, but it makes it very difficult to understand the whole because the more extensive the focus or the whole, the more difficult it is to carry out this process. It is an ideal solution for a small focus, but a large focus requires a lot of energy. Peter Watson observes the path of science throughout its history and defines this process of specialization, or atomization of knowledge, as deep but disconnected knowledge (Watson, 2017). Thus, knowledge explains the whole when there is multidisciplinarity, this implies that scientific atomization leads to disorder. Scientific convergence leads to order because when there is knowledge or information, there is a greater probability of order (see the section on complexity).

When there is multidisciplinarity, science converges, generates interdependencies, and gives a better and greater explanation of the whole. It is a progressive process, a continuum that makes science increasingly present in all areas of society.

Therefore, the second perspective seeks convergence and complements the first; this is where the vision of the three authors comes in: The first is Edgar Morin and his vision of complex thinking as a methodological tool to explain complexity; complexity explains the world. Where the world's order is carried out from human limitations, and science is searching for the best possible truth, there is no absolute truth; it is a path. Complex thinking (Morin & Pakman, 1994) fixes three principles in the researcher's mind throughout the investigation: 1) Dialogical principle: where opposite and complementary approaches converge. 2) Recursive principle or feedback: where the effect influences the cause. 3) Hologrammatic principle: where the part is in the whole, and the whole is in the part[1]. Conceive the whole by the parts and conceive the parts by the whole (something that can also be observed in the Theory of Quantum Mechanics). The second is Ramón Flecha and his dialogic vision as a method and application for improving society (Flecha, 2000). His vision influences the research, along with principles that coincide in many aspects that emerge throughout this dissertation, such as emergence behavior, co-creation action, equality and diversity as a generator of progress, social empowerment or democracy as a process of change and social improvement, the need for a good human projection for true democracy, or the orientation of science to society. The application of dialogic methods in education has been successful (Flecha, 2015), and the researcher considers this evidence of dialogic response to complexity. The third is José Antonio Rodríguez (Rodríguez, 2006) and his vision to imagine, discover, and create science through imagination. Science explains what transcends the human being, but it is still a human element, a human tool that allows us to understand what surrounds us and build a better future. This heuristic vision implies a vital demonstration and argumentation work; if the imagination cannot be applied, cannot be represented nor demonstrated, or follows erroneous premises, then it will not be a suitable scientific method.

5.1 Methodological Blocks

Various analysis methodologies have been used throughout the investigation, which can be differentiated into four methodological blocks. The work has a strong applicability component, using different methods for conceptualizing and designing a product or understanding the various tools and techniques used to generate the model.

1. **Explanatory research**: The research starts from a bibliographical and documentary analysis to a) argue the justification, b) define the context, c) create relationships between concepts, d) reduce, isolate, and identify the problems, and e) show the first

[1] To describe the hologrammatic principle, the example of the cell is used, where the human being is the totality, and the cell is a subtotal; in each cell, there is much information about the human being.

approximation to the solution and the attributes with which the model should be made. This part has a historicist component and has two motivations:

- Explain the reason for the investigation, there is a path towards a better democracy, a better form of organization. Explain the relationships between technology and society, linking the social and technological transitions, the transitions of the institutions, and how the creation of the State and the current corporate system is reached. To explain the different forms of organization, create a relational scheme of the elements that define the context, and identify the conditions of "balance," the externalities, and the result.
- Complex systems have a history and evolve, and their past is co-responsible for the current context (Cillers, 2002; Boal & Schultz, 2007). The historicist analysis also focuses on the study of complexity.

The historicist part tries to follow Piotr Sztompka's perspective of analysis, based on six ontological assumptions and six correlated methodological directives that make up a theoretical and methodological orientation known as "historical sociology" (Sztompka, 1986): 1) social reality is dynamic, 2) social reality is not a unique process, 3) the sequence of social processes is cumulative, 4) the social process is both human and social, 5) There is the dialectic between action and structure, 6) and time is contextual. Sztompka defines six ontological standpoints of social analysis: 1) social events are not isolated, 2) any state of society (or subsystems) should always be treated as a combined product of multiple concrete processes, running parallel, cross-cutting, contradicting or limiting each other, 3) social analysis is a trajectory, from past to the future, 4) explaining social phenomena and processes one must never rest content with mechanistic accounts from which actual human beings are absent, 5) the social events, phenomena, states of the social system should always be treated as "moments of becoming at which action and structure meet", 6) Social events or phenomena must always be considered as time and locally relative (Abrams, 1982).

2. **Exploratory research**: Once the context and the first questions have been defined, exploratory research, also bibliographical and historical, is carried out to wield the elements used to create social technology, as well as the different disciplines and techniques to be able to devise the solution, develop the model and its transition. This part focuses on four surroundings:
    a. On the one hand, in the study of decentralized models, a part of the bibliographic and documentary content has been obtained by following the Political Complexity course of the Systems Innovation Network.
    b. On the other hand, in the study of technological tools:

   i. Exploration of Artificial Intelligence (AI) techniques for the application to society, the initial bibliographic content comes from monitoring the ColumbiaX AI course and the book *Artificial Intelligence: A Modern Approach* (Russell & Norvig, 2010). That has allowed the researcher to know the techniques' definitions, limitations, and possibilities. The researcher has also attended a Singularity University event (2019) where he observed a technological trend at the time associated with asserting that the conceptual trajectory of the tool conforms to the trend.
   ii. Exploration of Distributed Ledger Technology (DLT) and Large-Scale Data techniques at the level of possibilities and limitations. The sources have been technical documents of initiatives and technologies.
   iii. Exploration of the different protocols, languages, functionalities, and pioneering projects in decentralizing assets, data, and AI. In this case, the sources have been these initiatives' whitepapers.
  c. Also, by approximating elements that define the individual dynamics with the collective ones. The human biological behavior course taught by Robert Sapolsky (StanfordX) has been followed. This knowledge has helped structure much information from other disciplines and is implicit throughout the investigation. The social relationship schemes, or what is called "social physics" (Pentland, 2015), have been deepened, consolidating the knowledge that was developed in the Master's thesis (Huerva, 2018). On this knowledge, it has delved into the Interdependence Theory, and connected it with the Systems Theory, defining a cybernetic scheme.
  d. Moreover, finally, the conceptualization of the form of decentralized AI and the forms of social prediction through algorithms based on classification and regression methods. The OCEAN model and the galvanic sensors known as electrodermal activity (EDA) or the existing cardiovascular sensors are explored. In this sense, the researcher's exploration of this type of device that captures the action and shows the psyche dates to 2005[2].

3. **Heuristic research**: Science also studies what is not seen, and imagination is key to understanding what is not seen. Science is the pursuit of knowledge, and this knowledge is based on empirical evidence. However, certain phenomena cannot be observed directly. Scientists must rely on their imagination to formulate theories and models to

[2] I had the opportunity to work with eye-tracking sensors that allowed for the observation of an individual's behavior on screen by following their retina and tracking where their eyes looked. At that time, the machine was rare and expensive, and there were very few in the world. Methodology had to be created little by little as projects were carried out. The researcher observed that although common patterns of information capture were established, each individual differed. Some read quickly, while others read slowly. Some only read if an image was associated with the text, and some spent more time on the image than others. Neither leisure behavior nor explicit processes for searching were the same, and at that time, not everyone tended to search from left to right. Though I did not have the knowledge I have now, I understood that this information could explain an individual's attributes without knowing them. If this information could be combined with other information, more information about personality could be obtained.

explain what is happening. Without imagination, science would be limited to what we can directly observe and measure at the moment, and we would miss out on many important discoveries. A process with a heuristic component is followed to specify the model. In this part, the perspective of the mathematician Polya is essential in his book *How to solve it* (Polya, 1973), which establishes various methods to solve a problem, how to understand the problem, how to devise a plan, how to execute it, or how to look back. And the best way to learn is through creation, one learns when one creates, but first, one must make it with one's head. It should be remembered that the heuristic method may not provide the perfect solution, but it defines the solution orientation well. Once Polya is discovered, it is hard not to read (Gigerenzer & Gaissmaier, 2011) to update the method and see how it applies to other examples that are not only mathematical. From a systemic thinking perspective, the method is considered in the sense of inventiveness, using the same schemes to relate concepts with categories and variables -through techniques such as Fast and Frugal Trees, or Trees Theory (Martignon et al., 2008)-. In this sense, the forms of multidisciplinary categorization have been of great help in organizing complex models (Amozurrutia, 2012); the program used to create the schemes and trees is Mind Vector[3].

The methodological process combines the different technological tools to devise new management forms, principles, rules, and dynamics that can respond to the model's premises, like a reverse engineering process. This process also carries out a documentary and bibliographical analysis of initiatives that are starting to exist nowadays, with elements in common with the model pursued by the investigation. Additionally, the practices used by different companies and organizations to identify habits and human activity are considered, as well as confidentiality and data treatment agreements are read. The first test is also carried out in a heuristic way, defining the bureaucratic and government structures. It also allows clarifying and internalizing concepts, detecting failures, which lead to new questions, and redefining existing ones. Thanks to this process, the elements that make up the model are defined.

4. **Applied Research:** Applied science uses the scientific method and knowledge to achieve practical objectives (Bunge, 1966). The investigation, from its beginnings, following the fifth point in the scientific values, has an orientation towards the social application in the execution; the scientist as an entrepreneur (Wiener, 1950), and the outcome of a sociologist is to improve society. The research has focused on the *how*, on transferability. This process includes the strategy, relations with other key agents, and how it can be executed. Execution is defined as a controlled environment for experimentation, or sandbox, to continue research, carry out tests, seek the feasibility and sustainability of the model, and be able to apply it to society, minimizing errors and making the model

[3] https://www.mindvectorweb.com

much more consistent. Crypto environment is not only extrapolated to economic terms, crypto can also be extrapolated to politics and social terms, defining a perfect experimentation ecosystem.

The research design has not followed an orderly sequence between methodologies, understood as first explanatory research and finally applied research. All of them are related to each other; descriptive study, on the one hand, guides the exploration, and on the other hand, it helps to fit what is explored with what is explained.

Heuristic research requires prior and subsequent explanation to understand, adjust and corroborate; and exploration as well, anterior to inspire or posterior to extrapolate and confirm. An example of a heuristic process can be seen in the complexity spheres, resulting from the researcher's imagination. These spheres arise from bibliographic knowledge, exploration, reflections, and connections between different disciplines that comprise this research, nobody specifies a sphere of complexity, but in the researcher's imagination, all write about this. The spheres of complexity have a foundation and coherence and give a plausible and approximate explanation of reality.

5.2 NLP techniques as a method

Developed in 2020[4], the Generative Pre-trained Transformer (GPT) is a way to generate language using Natural Language Processing (NLP), a neural network based on deep learning (Floridi & Chiriatti, 2020; Dale, 2021). Although it became popular in 2023 with its latest version of the chatbot, the researcher discovered Open AI in 2021 by looking for how the rights over the data of individuals and legal mediation with third parties could be executed; and how to extract the information in public debate (like a Kialo.com platform). Regardless of the functionalities sought in that part of the research, the researcher incorporated OpenAI, and Notion as additional work tools, not only as a classification, summary, or synthesis tool (low temperature in OpenAI Playground); but as a guide that can help strengthen exploratory paths (more temperature in OpenAI). The researcher considers that most of the scientific work must be done in low temperatures, if not, the tool only invents based on relationships between words and is unreliable.

It can be seen functionalities with some examples: "*What should I know in ten bullets about the relationship between power and education*".

"1. Power and education are inextricably linked. 2. Education is a tool of the powerful, used to maintain and reproduce existing power structures. 3. The content of education is determined by those in power and reflects their values and interests. 4. The educational system reinforces inequalities of class, race, and gender. 5. Those who control the educational system have a vested interest in maintaining the status quo. 6. Education can be used as a tool of resistance against oppressive power structures.

[4] GPT-3 is part of OpenAI; Microsoft has acquired it and has a pay-as-use business model.

7. Critical pedagogy is an approach to education that challenges dominant power relations and promotes social justice. 8. Freire's concept of "praxis" highlights the importance of critical reflection and action in transformative education. 9. Education is a site of struggle, where competing interests vie for control over the educational agenda. 10. The relationship between power and education is complex and dynamic, and constantly evolving".

The AI scheme compares open texts, generates labels, and extracts elements in common, confirming the relationship between concepts. It is unnecessary to copy the output; it simply corroborates an argument that will help sustain an investigation process or that no element is neglected. The researcher does not take the machine as truth, it merely generates text based on another text, creates text based on labels in a neuronal scheme network, and develops relationships between concepts and their texts. However, it also corroborates some elements of argumentation.

A more complex example of using this tool, where it cannot give a conclusive answer or has no clear relationship between terms, is shown when the researcher believes there are shared elements between cooperative learning and the dialogic methodology. Cooperative learning has proven to be effective in promoting social interdependence and cooperation among students (Johnson & Johnson, 2009), these are egalitarian environments between different parties that include diversity and lead to states of consensus; dialogic is the method that achieves consensus through the variety of perspectives (Flecha, 2015). The researcher's question to OpenAI (input) is as follows: ¿What is the relationship between cooperative learning and dialogic methodology?

The first output showing neural processing is: "There is no one definitive answer to this question, as the relationship between cooperative learning and dialogic methodology can vary depending on the specific context and implementation. However, in general, cooperative learning can be seen as a type of dialogic methodology in which learners work together to achieve a common goal. This can involve sharing ideas and perspectives and engaging in back-and-forth discussion in order to reach a consensus. Additionally, cooperative learning can also help to create an environment in which all learners feel safe and respected and are able to freely express their ideas."

In this example, the output shows the information the researcher already knows about both concepts and adds a relationship between them. OpenAI relies on large amounts of data from sources such as web pages, books, and Wikipedia; the response is configured based on a neural schema that analyzes open content and predicts an answer, but that does not mean the output is correct. First, if the temperature (OpenAI) is high, the model easily invents the response. And if the sources are biased or incorrect, the result will not be correct. So, it is the researcher's job to analyze the meaning and coherence; if he deems it convenient, search for an in-depth bibliography and explore it in greater depth. In other words, the researches corroborates the output of the algorithmic process with a solid theoretical body; like the process that goes through the review in scientific journals, it acts as a guarantor to eliminate bias. The researcher cannot take OpenAI answers lightly as truth because this neural learning scheme does not have access to the closed content of most scientific journals in such a way that it is proposed as a tool that helps to explore, later verify, and build an argument with a consistent theoretical framework.

Utility increases with multidisciplinary explorations: ¿Is there a relationship between thermodynamics and society dynamics? "The answer is yes. Thermodynamics is the branch of physics that deals with converting energy from one form to another, and society dynamics is the study of the interactions between individuals and groups in a society. There is a relationship between the two, in that thermodynamics can be used to analyze the effects of social interactions and societal changes on the energy balance of a system. For example, thermodynamics can be used to study the effects of different economic policies on the energy balance of a society".

The answer is quite different from that offered by keyword-based search tools. An in-depth literature review shows that both Betty Meggers (Meggers, 1955) and Leslie White (White, 1959) proposed that societies are thermodynamic systems that are subject to the laws of physics (Gill et al., 2007). The researcher knew this before employing OpenAI using traditional search tools. However, that required time, and uncertainty was present throughout the search by the bibliographic analysis before finding a theoretical set that related both concepts. Discovering a tool that indicated a relationship like the one the researcher initially referred to would have helped minimize uncertainty. Knowing there are other indications that one intuition is shared -although shared through an AI method- may indicate that the bibliographic search time process is not in vain. It must be pointed out that a lot can be learned from the bibliographic analysis, even if what is sought is not found. Although, as has been seen, the fact that the study of the texts carried out by the machine does not indicate a relationship does not mean that this relationship is nonexistent.

The example can be taken further when the research deals with technology to develop new forms of governance, articulates an argument based on a few elements, and asks: ¿what are the primary relationships between democracy, DAO, AI, and consensus? The first output shows: "The primary relationships between democracy, DAO, AI and consensus is that they are all tools used to facilitate decision-making in a decentralized system. In a democracy, citizens can vote on laws and policies that affect their lives. In a DAO, participants can use smart contracts to make decisions in a decentralized manner. AI can be used to automate processes, making decisions quicker and more accurate. Lastly, consensus is a method used by participants to reach a mutual agreement on a decision. All of these tools can be used together to create a more robust, efficient, and transparent decision-making system".

In a later output, the machine varies the ending: "Together, these tools and strategies can be used to create systems of governance that are more responsive to the needs of citizens, that are more efficient and reliable, and that are more resilient in times of crisis."

On one hand, the researcher has not yet mentioned smart contracts in the question, which is an essential part of the argument developed in the investigation. However, it is logical to include them since literature about DAOs and smart contracts always specifies them. The machine's response contains a joint functionality of the elements that coincide with one of the research objectives at the end of the answer. The second output includes attributes found in the research's key success factors and objectives. In this way, bibliographic analysis in doctoral research is the outcome of years of bibliographic work, and the method of relating AI information shows this coherence. Of course, this is not a formal validation, but it demonstrates that the research's logic and argumentation are shared by the machine's logic, which can confirm a significant probability that the study's reasoning is on the right track. It must be considered that the more and better the information the machine can process, the more and better the relations it can make, and the less probability of generating an error will show. In this sense, if the machine's ability to relate information is greater, the researcher and the machine leading to the same logic will be valid. The question is: when this machine is connected to closed information from trustworthy and unbiased sources, what kind of relationships and assertions will it make? An NLP neuronal scheme connected to the leading scientific journals will be a powerful tool for scientists. If this machine could manage other data information about the researcher's interests and work, it could be an impressive tool for developing science.

Although these AI tools were only discovered in the last part of this dissertation, it has been enough to understand their potential while corroborating the democratization and empowerment of the tools. Moreover, as will be seen later in the investigation, this classification scheme synthesizes and communicates the information and processes in the debates and proposals. It handles more comprehensive information and schematizes the individual ad-hoc in a transparent and aseptic way of power. The researcher did not use the GPT to write this dissertation; writing is a pleasure.

5.3 Organization Scheme

Below is the relationship between the different methodologies and the research output.

	Explanatory Research	Exploratory Research	Heuristic Research	Applied Research
Type	Bibliography	Bibliography Experiment	Bibliography Experiment	Experiment
Source	Articles, Books, Reports, Congress, Courses	Whitepapers, articles, Books, Reports, Congress, Courses, Apps	Whitepapers, Programming Plattforms, Apps	Foundation, Sandbox
Output	Justification, Relationship between concepts, Context	AI, Large Scale Data Analysis, Distributed Ledger Technology	Decentralized Autonomous Organization, The Uill, Social Machine, Hybrid Model	The chicken DAO Education sOS

Figure 2. Scheme of the design process.

5.4 Structure

The argumentation is structured into four blocks of analysis: the technological perspective, the perspective of change or trajectories, forms to organize complexity, and human measurement. Through these blocks, the trajectory and current situation are analyzed, and the theoretical sets and arguments are presented and related, which will be used later for conceptualizing, designing, and developing the devised model. The model definition is divided into three blocks: 1) data capture, 2) processing, and 3) control. Finally, the model's approximations for the execution are shown, along with the conclusions. applications, and next steps.

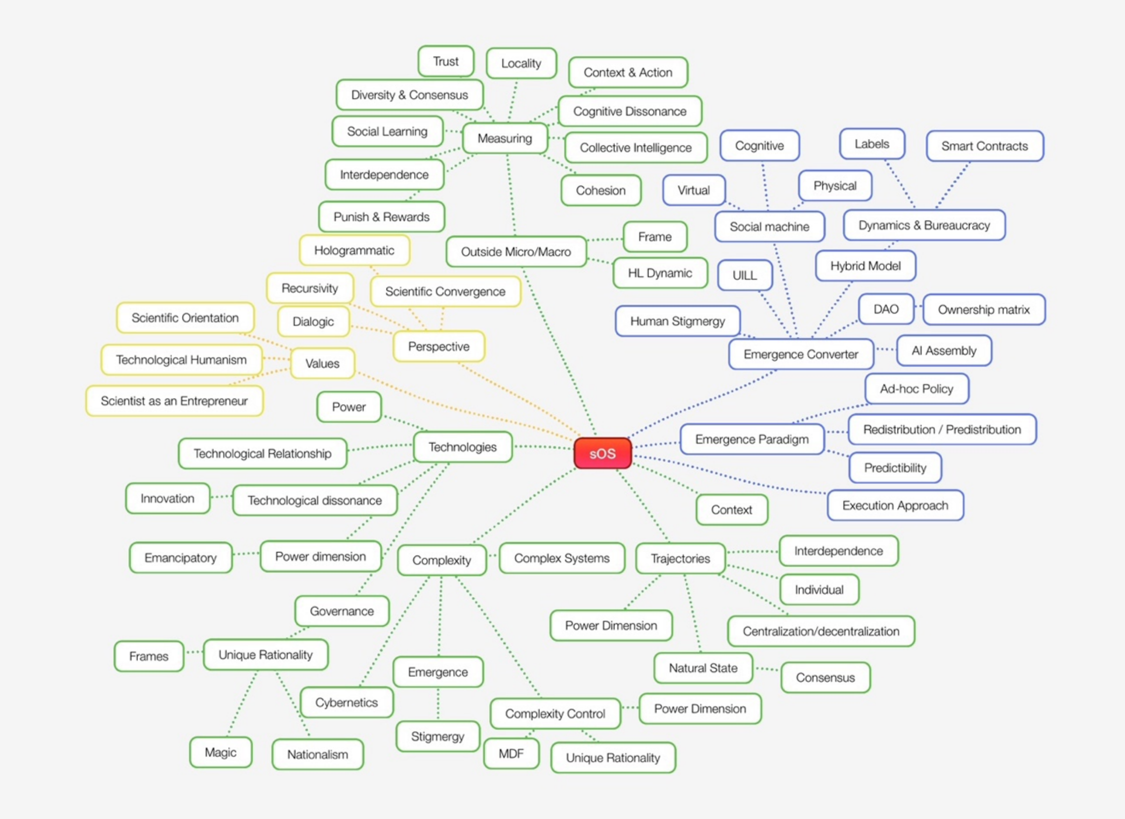

Figure 3: This schema presents the logical and conceptual scheme of the research. The research approach is highlighted in yellow, while the theoretical basis and argumentation are shown in green. Later, the solution is constructed in blue.

5.5 Criticism of the Multidisciplinary Approach

John Levi Martin reflects: "one must recognize that social scientists must be cautious about careless imports from other disciplines, especially those of the more prominent natural sciences (...) one must bear in mind that something useful in a science cannot have value for another" (Martín, 2003). It is a warning considered throughout the entire analytical, reflection, and interpretation process. The fact that a theoretical framework is used, or a part of the explanation of a discipline, does not mean that it is accepting all the postulates of that discipline, nor making the same inferences, since the object of study is different, or the context is different, or the medium is other.

5.6 Methodological Considerations

The work includes methodological individualism and systemic holism perspectives, their differences are appreciated but not understood as antagonistic and incompatible; they express reality from different angles. This is why, throughout the investigation, it is switched from one to the other. It is understood that the explanatory part of holistic research can tend towards reductionism. This does not interfere negatively with the investigation because it allows extracting points in common and critical information to explain and understand the whole. It also moves towards a micro-to-macro perspective, not only to cover a greater breadth of the investigation but because the conclusions of the different parts of the research indicate that the solution and the action go through emerging systems, empowerment, and greater bottom-up action to control complexity. And therefore, the scientific application process is conditioned by a micro-macro perspective to be applied coherently. The individualistic perspective is implicit in the individual's data collection model.

It must be considered that the research proposes to analyze aspects that are not directly observable but that exist and are underlying. This is why the researcher has been inspired by quantum mechanics writings, especially by Bunge and Heidenberg. Their research has shown the perspective about how to think theory considering the unobservable elements. This perspective has served as an inspiration to devise the data matrix and the bureaucratic form for decision-making and execution. The model compares and predicts all the elements with all the elements to find the variables that best define the synergies between individuals (big data + AI). This perspective allows one to imagine science and reality, but it will only be science once it can be demonstrated by scientific evidence and is replicable. The researcher understands that the imagination process is an important part of understanding and applying science. In this sense, this work pretends to show that what is imagined as reality can be demonstrated through relationships of scientific evidence. The work considers technology's substantive and instrumental perspectives, where the first, technology, has a deterministic role, and the second has a tool role. They are not contrary perspectives but complementary and compatible. Agriculture, i.e., is a technological tool and is deterministic in the human trajectory.

The researcher starts from his own experience and knowledge and from the experience and knowledge of his circle of close friends[5], who have also opened their circle so that the researcher can counteract or discover how to pursue the model. In this sense, this investigation results from all the interactions with people the researcher has throughout the study.

[5] The discussion and reflection with friends have been an element that influenced me even before the conception of the thesis, being a sociology student. I can use the example of how this doctoral thesis originated; I was discussing with a friend the perversity of how the data was used. I defended that neither a private company nor a state company should control a person's data given the perversity it represents. Finally, my friend accepted that private companies were neither a secure data management solution. Still, he added that what I argued was impossible because there needed to be another kind of organization that did not exist. He was right. Both existing social organization technologies generated a perverse determinism in the interests of the data and did not satisfy me.
I am very skeptical of social determinism, which motivated me to find and define a way to do it. After a while, I told this friend about the DAOs. His response was: "yes, but how the people are managed in this DAO, and after "yes, but (x)." This response was typical in most of my friends and acquaintances and motivated the search for alternatives and solutions until the "yes, but (x)" was reduced. The real unknown began when the "yes, but (x)" started to disappear.

5.7 Reflection as a Method

This work shows implicit processes of reflection, but there are also explicit ones, for instance, the moment of defining the context and the problem stands out, and the moment after the strategy of the model. A premise has marked the latter: "optimistic in the will, pessimistic in science." Criticism and antithesis have been sought; the model has been questioned. It has been shown to economists, sociologists, political scientists, experts in companies and public institutions, and people who, regardless of technical knowledge, can contribute to the research and represent society, looking for bugs, problems, and improvements. This process has been essential to understand better the consequences of the model itself and its plausibility, and also, to be able to think about organizing applied research better. However, even so, the researcher always maintains a critical position with the model itself; everything can be improved.

5.8 Obstacles

At the methodological level, the research has encountered two critical obstacles. The first is that the Research Plan refers to aspects of concepts that do not exist, questions such as ¿How is a decentralized environment organized? ¿How can bureaucracy gear up a decentralized environment? How are policies designed in a decentralized environment?

This means the work must create this model and answer the questions by creating a design. Once this design is conceptualized, with defined dynamics and mechanisms, the questions can be answered. This first obstacle leads to the second obstacle and shows the lack of tools that enable the application or execution of the model. This consideration means that if the tools do not exist, they must be designed. Initially, it was sought to develop the code necessary to create the model, which represented a very high cost and diverted the investigation. The research strategy takes advantage of the current explosion of technologies to create DAOs, and develop protocols, languages, and platforms. This allows for more efficient and effective model composition using existing elements. However, developing implementations that do not yet exist poses a challenge when seeking expert input. Furthermore, the execution of the model requires not only software tools but also legal tools and regulatory frameworks. In 2020, finding lawyers and legal experts knowledgeable in DLT or AI technologies is also challenging.

The work raises new paradigms where established bureaucratic forms and regulations cannot provide an answer. Furthermore, doing decentralization testing in a centralized context is very difficult because running a decentralized regulation in a centralized regulation environment is complicated, and, in some cases, incompatible. An example is how the institutional figure of the DAO is structured, the organizational model that develops the research that allows the individuals to simultaneously be a consumer, worker, and investor of the institution, always being the owner. This scheme is incompatible with the current labor, economic, and commercial regulatory frameworks; it does not allow the creation of decentralized and open forms of organization; current legislation does not contemplate them; it separates the owner and the worker, and it defines the frame of responsibility and power.

As Hassan & De Filippi rightly point out, the problem arises because a DAO's "autonomous" nature is incompatible with legal personality since legal personality can only be established if one or more identified actors are responsible for the actions of a particular entity. The discussion about whether a DAO should be recognized as a legal person has important implications in the legal field since it can determine to what extent a DAO can be considered a legal entity separate from its human actors and, therefore, the extent to which these actors can shield themselves from the responsibilities of the DAO (Hassan & De Filippi, 2021). In the model proposed in this dissertation, the responsibilities are dynamic according to the labels of the individuals.

The researcher notes that centralized regulation cannot be extrapolated to decentralized regulation as these are different prisms. All individuals who make up the DAO are responsible for their actions and decisions. No one represents everyone or has more power or responsibility over the rest (see delegate smart contract section). For this reason, it is important to give special attention to defining a controlled environment for experimentation or sandbox (Allen, 2019), which allows for developing and testing the model's possibilities. This is the theoretical application of the model, creating the pillars of a decentralized scientific research institution (DAO_{SC}) that follows the line of research that defines this doctoral thesis and promotes the application of science for the benefit of society.

6 Theoretical Frameworks

To argue the entire scientific explanation and develop the model, the researcher defines four theoretical groups:

6.1 Set 1

It includes the analysis of technology, from its definition and why, its relationship with the physical and social contexts, or the determinism it entails. To do this, it is based on analyzing the forms of organization of different civilizations in their physical and social contexts.

As mentioned in the methodology section, the theoretical basis of this part is primarily historicist; it traces the history of technologies, civilizations, and social transformations and looks for relationships between facts to find links. Distinguishes different forms of social organization and records the history of law and politics. It also focuses on the relationships between different technologies and the role of social innovation. The work needs to focus not only on the changes in the individual or society due to technologies but also on the contextual changes produced by them, showing a feedback system between changes in physical and social contexts, and the recursive and hologrammatic principles (Morin & Pakman, 1994).

It also declines particular emphasis on the magical context to explain the ecosystem. Regarding the trajectories of government and the different types, the analysis is based on the bibliographic set on the various courses of social organization and governance developed from the different genesis and the different contexts to the current forms of State, from the origins to the present complexities. The vision from the following theoretical frameworks Framing Theory, Homo Ludens Theory, Economic Philosophy, Political Philosophy, Conflict Theory, and Revolutions Theory complements this analysis.

This first set exposes the visions of understanding the trajectories of the forms of social organization and emphasizes the transformation process towards modernity, which defines the current forms of thought and social organization. The bibliographical analysis focuses on the interruption of automation and social organization, the "religious fracture," scientific acceptance, the development of bureaucracy, the development of powers, and the conception of the State.

It considers the relationship between physical and social technologies, the disruption process is not only characteristic of physical technology but also typical of social technology. New ways of thinking and organizing emerge to explain the reality that triggers changes in the social context, together with the agricultural, energy, and productive transformations of technological disruption, define the pillars of generating wealth, development, and social organization. This part of the investigation is inspired by authors such as Tocqueville, Tönnies, Hobbes, Robespierre, Bakunin, Descartes, Montesquieu, Stuart Mill, Kant, Compte, Saint Simón, Smith, Robert Owen, Charles Fourier, or Locke among others as well as the subsequent analyzes carried out by authors such as Robert Merton, Max Weber, Norbert Elias, Karl Polanyi, Amartya Sen, or Francis Fukuyama among others. It is worth mentioning Ruy Gabarrón's doctoral thesis: Democracy and Data, Efficient Democratization and its Elements, which helps to define the current situation of democracy.

6.2 Set 2

Set 1 defines the pillars of the physical and social contextual framework, an ecosystem, and the theoretical set describes and explains. Set 2 analyzes this context from different perspectives that respond to the following theoretical frameworks: Institutional Theory and Bounded Rationality, Games Theory, Network Theory, Systems Theory, Complexity Theory, General Social Theory, Conflict Theory (power dimension), and Chaos Theory.

6.3 Set 3

Once the contextual analysis has been carried out, and the starting point and the problem have been defined, the approach to the solution begins by exploring what technological elements or tools can be used to create an organizational and governance solution. The support in this part initially does not come from theoretical frameworks per se but from the techniques of computing large volumes of data, autonomous learning techniques, Machine Learning (ML), Distributed Ledger technology (DLT), and blockchain applications. Even when the case studies and examples have been corporate or business-oriented, learning these techniques has allowed the investigation to apply them to social contexts. The premise is to use these technologies for social benefit.

After a comprehensive understanding of three disciplines, namely Human-biological Behavior Theory, Cognitive Balance Theory, and Social Capital Theory, theoretical frameworks from prominent authors such as Sapolsky, Putnam, and Pentland has been also considered. The section that delineates the data model based on the dissertation (Huerva, 2018) incorporates the theoretical foundation and alludes to the data collected by companies that commercialize individuals' data. Additionally, the study considers the theoretical model that utilizes the OCEAN methodology, which Cambridge Analytica -among others- employed and fine-tuned. Notably, companies operating in this domain and their employees tend not to publish in scientific journals due to the confidentiality clauses in their contracts. So, the theoretical framework on which two sides base this part of the investigation: 1) the agreements on the data that are accepted when using the services of said companies (what the related companies are obliged to write about data gathering and treatment from social networks). And on the other, 2) through blogs, YouTubers, friends, and acquaintances. The analysis is critical of digital social network knowledge due to the noise of interests, but this has not been impeded at a theoretical level since, regardless of the reliability of this information, the objective is a relational scheme of social concepts that can be captured through the devices.

The third theoretical set includes the model's specification, design, and dynamics. The authors that make up the theoretical basis to which the model is referred are classified by disciplines and authors from the first set, especially on Political Philosophy, Economic Philosophy, Philosophy of Social Sciences, Network Theory, Social Capital Theory, Social Behavior Theory, Cognitive Balance Theory, Human Behavior Theory, Institutional Theory, and analysis of organizations. The defined model fits with the Complex Adaptive Systems Theory (CAS).

6.4 Set 4

Throughout the dissertation, few references are made to authors who have been the fathers of quantum physics, such as Bunge or Heisenberg. His theoretical perspective has been an inspiration to understand society, it is a theoretical set implicit in the research and not explicit. A parallel dissertation could be written on applying quantum mechanics to society. An inspiration that has been kept in mind when defining the model and understanding context complexity.

As noted in the methodological section, the research was possible thanks to the researcher's network of friends and acquaintances. This has allowed access to information and experiences, although not found in a bibliographical form. They have been a guide to investigate, to discover new bibliography, or to assert that the path is correct or erroneous. This knowledge is implicit in the research.

Chapter II

7 Technology

The argument begins by analyzing technology because the research is based on the convention that it is a backbone element that has contributed to the development of humanity since its inception. The human being has a cognitive system developed by the use of tools and fire, and the ways of organizing also changed with the discovery of agriculture. The human trajectory is linked to technology.

7.1 First Technology Definition

The definition of what technology is, its implications and impacts, and its relationship with society, are aspects that define a category of research questions. Of the multiple definitions of technology that this work has seen, initially, it starts from: Technology is the set of knowledge and techniques that result in tools or artifacts with functionality or purpose, which is usually solving problems or satisfying needs. Also, the technological development process is composed of 1) a problem or need, 2) an idea or solution, and 3) an application. A process where knowledge or science joins skills or techniques to solve a need or a problem. And that this, depending on whether it starts from a hard or soft scientific discipline, is derived from a hard or soft technology.

This definition conforms to the initial objectives of the research. However, a broader definition must contain the social components of technology, the impressions in the contexts, the relationships it generates, or the dynamics it follows. William Fielding Ogburn, in *How Technology Changes Society*, observes that technology changes society by changing the ecosystem, an ecosystem to which society at the same time adapts (Ogburn, 1947); the researcher interprets at this moment for the first time hologrammatic and recursivity principles. It has also analyzed the most relevant studies in technological sociology and thus can connect it more concretely when proposing the investigation, starting from the premise that technology is social. To understand the relationship between technology and society, the research needs to delve into the history of technology and analyze the changes that artifacts produce in society. Finally, it has deepened the analysis of ecosystems, and thus be able to complete a definition or a broad knowledge that adjusts to the research requirements.

The technology definition should be made up of a series of components, from the complexity and dependency it generates, the dissonance between the two contexts (physical and social), the relationships between the two technologies, the power or democratization or emancipation it presents, to the determinism it implies and the associated magical connotations.

7.2 Technological Perspectives

There are several perspectives to understanding technology, Edgar Morin, distinguishes between two worldviews: technologists and ecologists (Morin & Pakman, 1994; Morin, 1999). The first states that technology is the dynamic element that moves the human being. It is a deterministic conception because it is based on the fact that where human biology does not arrive, technology arrives (this dissertation will not delve into transhumanism), and there are no limits. The second states that technology is simply a means, a tool, and that the changes produced in society are through education, science, and politics. A perspective that tends that technology contributes to the planet's destruction. The researcher finds a priori a great distance on this point, especially if the two conceptions remain contrary. It would be logical to position and defend one or the other, but the reflection passes through that they are not opposite conceptions but complement each other; these are perspectives that show the same thing.

However, science studies the natural world through observation and experimentation, while technology practically applies scientific knowledge for specific purposes. The purpose of science is to understand and explain the contexts (complexity); the methodologies as the way to understand/control what surrounds us (e.g., math) can be considered a technology by itself, a tool to understand. Nathan Rosenberg develops the dialectical relationship between science and technology (Rosenberg, 1984) and affirms that the role of science determines the rate of technological progress. This research explores the concept that science, politics, markets, and education are all social technologies. Social technologies could share elements in common with physical technologies, such as obsolescence or accessibility. And both technologies are so conditioned that they can be categorized in many cases as determinants, even though one moves in the physical context and the other in the social context.

The research suggests that a deeper understanding of the relationship between science and technology is necessary for effective social progress. By recognizing the impact of social technologies, we can better design policies and initiatives that facilitate positive social change.

The instrumentalist vision focuses on technology from a physical and material perspective so that it can be decided whether to use a tool or not. But accepting some technologies, and others not, also implies denying the social technologies related to the discarded physical technologies. The extreme case would be a total denial of technology due to its complexity, but it would deny the printing press or agriculture; it would deny other technologies, such as science, education or modern democracy, where the previous ones are involved. The work of Kevin Kelly about the Amish technological adoption has also been considered (Kelly, 2010).

That does not mean that there is only one path for technological development. The atom can be taken as an example, where its first "notorious" application was the nuclear bomb, the atomic bomb cannot be denied; it is accepted that this phenomenon opened and defined new frontiers in physics and that it defines our trajectory of progress. But the path to the atom does not have to go through the application of the nuclear bomb; there are other paths. And this is a crucial aspect because, as will be seen throughout the research work, it has been detected on various occasions that war is "the technological engine" of humanity. And this relationship is indeed appreciated when the facts; technology entails power, and war is the maximum expression of power.

7.3 The Power of Technology

Starting from trajectories where war is an established economic and political form of governance, it is logical that war and technology have gone hand in hand (Kaldor, 2012). But neither should it be inferred that war should continue to be the motivator and the exponent of human technological advance. Traditionally, the four powers have been differentiated into a) War or military, b) Chaman, King or State, c) Energy, and d) Economy (some authors like Noam Chomsky or Steven Lukes argue that media is the fifth power). In order to understand the relationship between war and technology, it is important to consider how these powers interact and shape technological progress (Klein, 2007), so it is reasonable to assume that these powers have conducted the application of technology in warfare.

If technologies make it possible to improve the control of ecosystems or contexts, they are technological tools subject to power dynamics (like resources); then it seems that a priori, it could be inferred that controlling technology is controlling physical and social contexts. To carefully analyze these relationships, the theoretical framework provided by Carl Benedikt Frey is mainly used in his analysis of power relations between technology and society, complemented by other authors, more focused on Conflict Theories.

Initially, the argumentation starts from a premise of power, which comes from the fact that a set of physical technologies makes it possible to control physical and social contexts. Also, those who want the power of these technologies to be able to control these contexts. Furthermore, those who master this set of technologies establish the norms by which society is organized. Defining a social context reproduced through the cultural structure[6] (Sabaté, 2019), establishes a constant over time, where the balance of who holds power changes from one side to the other. However, it is a "static" power based on the same technological set; it does not change because the socio-technological tools are the same, and only those who use them change. It is a static power defined by technical limits and by those who have access to those technologies. Nevertheless, an element enters the equation, which means that the model is not a constant hegemony between two power-holding sides: creating a new technology or the component of technological empowerment puts both old powers in check forces. Since technology creates a new agent, a third agent with a new power, the power is more "dynamic[7]." Technologies create

[6] Social structures: 1 Demographic, 2 Economic, 3 Political, 4 Cultural, the latter is the one that reproduces and mutates the other structures.

[7] The researcher distinguishes between static and dynamic by the number of agents with power capacity and the transferences of power between agents.

new agents of power, of influence. This situation leads to new agents accessing power with different new technological tools to control the context better, and probably also for their benefit.

However, at the same time, these social transition processes are tough, not only because of the old interests and defined habits of the old powers but also because whoever master the new technologies establishes their power without control (Frey, 2019).

Another example can be taken from the collapse of the Bronze Age. For the elaboration of this metal, tin is required, found in the Middle East; at that time, it was local and not an abundant material, a strategic and controlled resource. It was a period where complex social structures or pseudo-States with a monopoly on bronze had to dedicate a lot of effort and energy to defend themselves from less complex social systems that could not compete for access to bronze. If, in addition, the eruption of a volcano that shows a large part of the territory with ash is added to this situation, diminishing crops, then rebellions arise because the Gods are angry with the kings, and that civilization collapses. But precisely in this situation, the difficulty of access to bronze promotes the development of iron metallurgy for those who do not have access to bronze. And those who have control of bronze-based technologies have lost their hegemony. The discovery of iron was a considerable advance -except for those who had control of the bronze- it transformed new cultures and religions and also changed the monopoly of power, adding new players.

It is an example of empowerment and technological democratization that is more than three thousand years old, and that suggests that there are relationships between technology and power, laws of power are followed; power and social change are two elements that are also related to technology. But it can also be seen in the transition to modernity, from a process with a governance hegemony based on a binomial, king, and church, that articulate an economic-and-social form based on an agricultural economy and wars for resources through warlords or nobles. A regime that, as can be seen in the complexity section, allows little progress but maintains a hegemony of power through control of the physical and social ecosystems. A hegemony of power that began to suffer with the discovery of the printing press, lenses, or telescope, essential for the Renaissance, Humanism, Positivism, Enlightenment, or science; these are also necessary for agrarian transformation or mechanization. Basically, it is a set of technologies that better explain the context and allow greater control of it. Technology controls/explains physical and social contexts.

If there is a power that controls the contexts through technologies and, another power arises based on technologies that show better comparative advantages than the previous ones. Then, regardless they were the Landlords, Peers, Seigneurs, Pairie, Junkers, or the Great Ones of Spain, they could hold power and create laws that prohibited the sale of products manufactured by machines in the markets[8] and jeopardized their power status. That, in front of the new agents that control the latest technologies, their ability to maintain power (based on old technologies) will be lower (technologies based on land vs. technologies based on machines). Furthermore, once the new agents settle in the formal government, they create the norms and laws that benefit them based on the new paradigm presented by these new technologies that they dominate (Ibid.).

Everything that represents the power of the land and the traditional economic forms associated with it become obsolete; machines, energy, and industrialization change the metrics (Thomson, 1979a) and the scales (Frey, 2019). Adam Smith studied the relationship between machines and labor relations, a balance of production relations can be established utilizing an "invisible hand" (Smith, 2012; Sen, 2000) based on individualism and materialism. Something that has marked today's society since machines transform the demographic structure (Frey, 2019), the resource management -economic structure- (Freeman & Soete, 1997), the social organization -political structure- (Elias, 1998), and, therefore, the traditions and norms -cultural structure- (Deleuze, 1992). Norbert Elias affirms that power is bipolar at least and normally multipolar (Elias, 1998); it is observed that technology allows the emergence of a new regime and new agents, which are strengthened over the previous ones based on previous technologies. It establishes a new paradigm based on empowering a series of technological elements, something that has already happened, as in the transition from bronze to iron example.

This empowerment is part of technology's inherent democratization because technology has become more accessible. The work considers that this is because technology has a devaluation component, which a priori, the researcher hypothesized is caused by a process similar to 1) the efficiency of a created technology, 2) the axiom of technology on technology, and 3) the effect of Metcalfe's Law or Reed's Law. And that leads to 4) "destructive creativity," and thus, technological products become obsolete and more accessible.

This would also lead to taking advantage of this axiom in a market environment where there is always a new product or a new technological element, thus creating an economy. Or that, in a war environment, technological obsolescence was a determining factor for subsistence.

At the same time, the work of Javier Bustamante is revealing, where he defines the relationship of the intermediate ethical vectors in the hidden innovation that he observes in social technology (Bustamante, 2013). This relationship is made up of three Laws:

a. Metcalfe's Law, or the network effect, where the value of a technology is proportional to the square, where *n* is the number of individuals who use the technology. The

[8] The laws that prohibited the sale of products made in factories explain part of why France lost the colonial battle against England (Frey, 2019).

difference between Metcalfe's Law and Reed's Law is based on the fact that the first is square, and the second is logarithmic.

b. Law of increasing adoption returns, by Brian Arthur (Arthur, 1989): "The greater the number of participants in virtual communities, the greater the utility of the tool for each of them, and the greater practical utility and relevance scientist has the information created from that interaction" (Bustamante, 2013).
c. Law of positive externalities, based on the externalities that Pigou and Marshall define, where it is not the same thing that, from the relationship of two, a negative externality arises towards a third party, or that, from the relationship of two, a positive externality arises towards a third. A concept that the research considers similar to positive/negative interdependencies.

Until here, the dissertation interprets that in the scheme of the relation of technologies (Fig. 4), the technologies considered emancipatory are characterized by: 1) the element of social empowerment (c) 2) these are more efficient or effective than the previous technologies, 3) accessibility and usage of technology (a $\wedge$ b). Based on the theoretical framework of the complexity section, one can see that the emancipation component is also defined by the capacity and type of interdependence (positive or negative feedback) that this new technological tool allows (emancipatory technologies are positive feedback). "Interdependence is a relationship in which two or more things depend on each other. Feedback is a process in which information about the results of a process is used to improve the efficiency of that process" (Johnson & Johnson, 2009).

Turchin and his research team developed a cultural evolutionary model that predicts where, when, and why the largest complex societies arose in human history. And it seems that the explanation lies mainly in the war and the related technologies and geographical characteristics. The model that includes military technology explains 65% of the variance of the data, and the model that does not have this dimension explains 16% of the variance of the data (Turchin et al., 2013). There is a similarity with what Jared Diamond explains: the role of technology and geographic context through wars is critical to understanding cultural development and the progression or fall of civilizations (Diamond, 1999).

The invention of the horseshoe around 100 BC allowed horses and oxen to improve their working capacity, something that, although it may seem simple at the time, was as great an advance as the appearance of machines (Elias, 1998). Also important is the invention of stirrups in the 13th century, which was an enormous advance that created a new power (White, 1962; Rosenberg, 1984; Bustamante, 2013). The stirrups allowed a single individual to control a horse and free their hands to wield a sword and shield. The empowerment granted by this technological invention was so great that it triggered the orders of chivalry, an institution of power that would also structure and define feudal society (Bustamante, 2013).

Or the example that Elias describes the configuration and creation of the State: "(...) *thanks to the slow development of firearms, the mass of commoners who fought on foot ended up imposing themselves on the small number of nobles who fought on horseback. This favorably influenced the central power*[9]" (Elias, 1998). All this evidence shows that inventions, physical tools, or artifacts remain in the material field and transcend the social field. Material technology changes society's structure and creates forms of social organization and social technologies.

7.4 Social Technologies

Following the hologrammatic and recursive principles, all these physical technological innovations could not have been realized without a corresponding social organization that could carry them out and handles all this complexity. Some authors define social technology as a movement that guides the development of products, processes, techniques, or methodologies designed based on users' needs through the union of communities' traditional knowledge with technical, academic, and scientific expertise as its primary objective is the social inclusion of certain groups not covered by conventional technology, which is promoted by large corporations (Nascimento et al., 2019). Others associate the term with communication and information technologies such as Facebook, Twitter, videoconferencing, etc. (Nisar, 2019; Laurel & Wang, 2022); or applications that use web 2.0 technology (Leonardi, 2013; Mardi et al., 2018). Bruggencate defines social technology as technology that allows social interaction (Bruggencate, 2020); which is similar to the concept of Information and Communication Technologies (ICT). The analysis infers that ICTs promote interdependencies among individuals, something essential for social organization. In such a way, interdependency is a crucial element of social technologies because social technologies configure interdependences.

William Richard Scott describes two dimensions: 1) Technical or material-resource environments, and 2) Institutional or regulative, normative, and cultural-cognitive environments. (Scott & Davis, 2000). Beinhocker expands research on social technologies based on Nelson's distinction between physical and social technologies (Nelson, 2003). Physical technologies are designs and processes for transforming matter, energy, and information in ways useful for human purposes, such as turning sand into glass or silicon chips. Social technologies are just as important but often less at the forefront of our minds. These are the designs, processes, and rules humans use to organize themselves. Examples of social technologies include villages, armies, paper money, the rule of law, and inventory management (Beinhocker, 2006).

Nelson affirms that one of the most relevant examples of social technology is the Multi-Divisional Form (MDF) model (Nelson, 2003), of which Chandler carried out an extensive analysis

[9] The citations from (Elias, 1998) are translated from Spanish.

(Chandler, 1977); also, under this definition, Leonardi calls organizations sociotechnical systems" (Leonardi, 2013).

Subsequently, the first text referencing social technology (Small, 1898) is analyzed. Albion Woodbury Small talks about the world of things and the world of people and seeks to define a method to measure society. He uses the concept of social technology to unite the individual with society. In other words, a) there is an individual, b) there is a society, and c) social technology unites these two (Small, 1898). Derksen's work develops the concept of social technology, with a conception that turns more into a social engineering tool than aspects of social innovation (Derksen, 2013).

Taxation, democracy, or the credit system. These are considered social technologies (Stevenson, 2004) since they start from a conception that the economy is social. They contribute to control, explain the physical and social contexts, and contribute to social organization. Ergo, institutions are considered social technologies; these are also covered from different perspectives, from the organic and biologist, and where it is recurrent to find similes of institutions such as "cellular pacemakers" (Johnson, 2003). Or also from the Field Theory, which defines the institution as a pattern of regularized conduct, and which is better studied in terms of observable regularities (Martin, 2003). Changes in social technologies can be seen in Weber's analysis of the relationship between Puritanism and capitalism or Merton's relationship between Protestantism and positivism (Merton, 1938). Both describe and explain transitions, new ways of understanding the world and governing oneself, both examples of social technology. The perspective of research on changes in social technologies is that these changes are "system updates," programs that activate and enable new system capabilities, the vision of a Social Operating System (sOS), where they add new functions and powers.

McLuhan reflects on the impacts of technology on life, primarily through the media, and establishes ways to measure its effects (McLuhan, 1995). Technology is an element linked to social changes (Rosenberg, 1982), and the exercise of relating the technological impact of the artifacts created by society also relates to social transformations, thus understanding social change from an added perspective; of how the transformation of "things", of the material, changes people's thoughts. Clay Shirky points out that the media have transformed nowadays; society has gone from one-to-one communication, such as a telephone conversation, to Mass Media Communication (MMC), such as radio or television, and represented one-to-many communication. Currently, there is a move to many-to-many communication, with platforms such as YouTube (Shirky, 2011), Instagram, or TikTok. It is a social transformation that promotes new ways of understanding reality and organizing based on it.

7.5 Relations between Physical and Social Technologies

Shirky's reflection shows, on the one hand, that the concentrated power that "one to many" represents, typical of the MMC, is diluted at the moment in which that power is distributed to all, it is no longer "one" that has the power to disseminate information, but everyone has the power to share information. And on the other hand, he shows that physical innovations lead to social innovations, which can also be evidenced by the example of the development of the transportation technique, which begins with the water mill. And it is for this reason that cobblestones are made on the roads, and it begins to be worthwhile to transport the grain over greater distances (Elias, 1998). A physical tool that transforms energy and allows efficiency (water mill), and thanks to this tool, individuals create a grain market; if the market is considered at that time as a social innovation, this condition the creation of paving stones on the roads, an infrastructure, new vehicles, etc. The same author points out that this was also a step on the path of differentiation and interrelation of the distinction of functions within the closed area of the agricultural manor.

Beinhocker's perspective is based on an economic principle, where this principle is the one that unites the two technologies. He claims that economies are based on the existence of two factors: 1) physical technologies that allow individuals products and services that can be exchanged (promote interdependency), and 2) social technologies that allow the cooperation and coordination necessary for exchanges to exist in a favorable environment for these two factors such as a State.

The capacity for interrelation and interdependence offered by the market was a significant advance in social technology, it projected new ways of organizing, and it is an explanation that fits in a context like the current one. But for the researcher, it is not enough to explain the inherent relationship between physical and social technologies or other contexts where, for example, a magical explanation of reality perhaps has more weight than an economic explanation. Since this relationship has also existed without these elements, such as the putting-out system, in the proto-industrial revolution, merchants provided materials for manufacturing to peasants under this system. Once the production was complete, the merchant returned to offer more work and pay them in food. However, if the peasants already had sufficient food, they refused to accept the additional work as it was considered a sin (related to the original sin).

To understand the relationships between both types of technologies, the study starts with the Hanson scheme (Hanson, 2008), also used by the Singularity Theories. Moreover, it adapts to a relational scheme that includes the physical and social dimensions of technologies (physical and social technology), and through the axes, time and complexity are represented (Fig. 4). So, physical and social technologies have been added to this scheme, and then, using a deductible logic process, relate the elements that connect them. This relational scheme would be complemented by contextual situations in the way that, to understand the relationships between physical and social technologies, one must also consider the contexts that condition innovations. However, it is possible to visualize a progression due to the concatenation of technologies of both dimensions, which comprise the recursive principle.

Two aspects call attention to the researcher:

- Doing a small exercise, writing in one column the physical technologies (t=0) and in the next the social technologies (t=0) derived from the physical, and in the next column the physical ones (t=1) derived from the social technologies (t=1), and so on (t=n), one can relate technology's physical and social dimensions. And this relationship follows a logarithmic projection, similar to Reed's Law or Metcalfe's Law. The researcher speculates that the relationship between physical and social technologies also follows some Law, a constant, or a set of parameters.
- Considering the statements of Betty Meggers (Meggers, 1955), Leslie White (White, 1959), and Gill's group (Gill et al., 2007), who refer to societies as systems governed by the second thermodynamic law, it is inferred that the scope of agriculture resembles an energy revolution of humanity, as well the hunting tools, or the use of fire. At the same time, hunting requires social technology and organization, thanks to the energy revolution. This energy perspective can also be seen in (Poudel & Mcgowan, 2019).

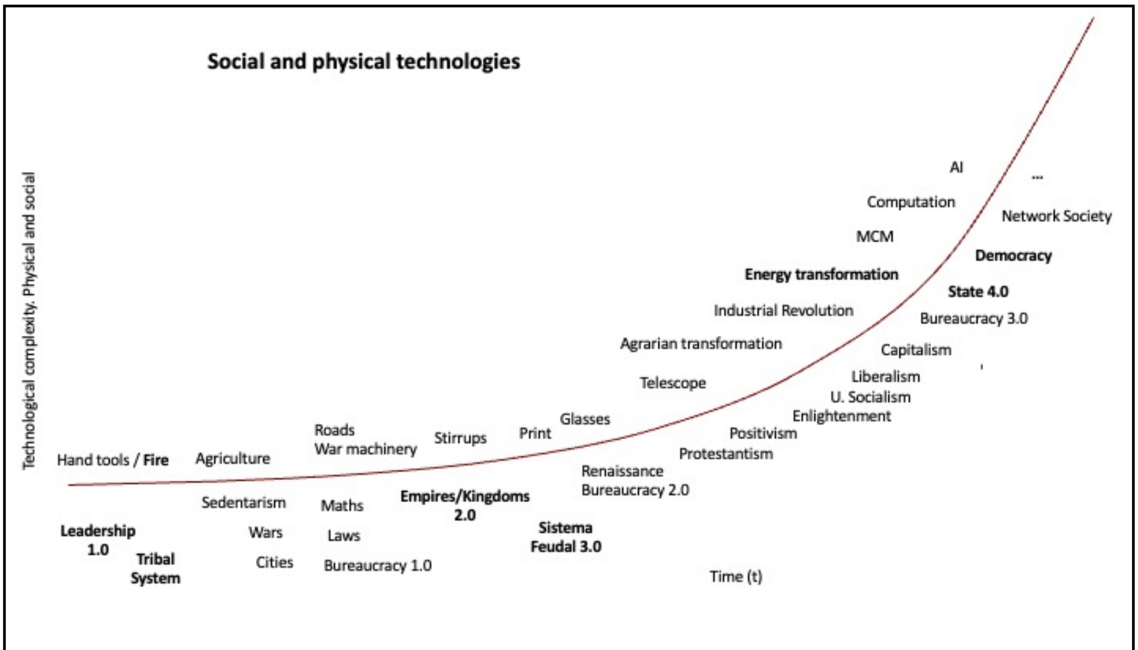

Figure 4. The scheme relates physical technologies to social technologies. The (y) axis shows physical and social-technological complexity. The (x) axis shows the timeline. The researcher speculates if a logistic map relation $X_{n+1}=rx_n(1-x_n)$ could explain this progression but will not go deeper in that way.

As mentioned, Tony Stevenson's article includes a reflection on "social technologies," in which he refers to the institutions of democracy or the credit system (Stevenson, 2004). Lenses were not invented for economic purposes, but they also helped explain the Renaissance, helping to draw the characteristic detail of that age for the first time (Ilardi, 2007). It can be affirmed that the lenses create an individual and social transformation regardless of the economic or mercantilist aspect with which they are also used since they take much more advantage of the invention of the printing press. The research cannot confirm a direct causality between the printing press and lenses. However, if one considers that the inventor was a Franciscan monk in Pisa, it would be easy to link a relationship with books. In any case, processing information through lenses gives society a better information set. The line of progress and the ability to handle information is unthinkable without using glasses. The sum of many physical innovations arises multiple social innovations, and the sum of many social innovations arises multiple physical innovations.

William Ogburn was the first to propose a distinction between technical and social inventions (Ogburn, 1947; Sesto, 1983). Well, the writings of Leslie White (White, 1959; 1962), Nathan Rosenberg (Rosenberg, 1982), and Jared Diamond (Diamond, 1999) speak about wars and the technologies related to them as the genesis of the rest of the technologies that have moved society. Even Merton indicates that the rise of medicine came from the wars in the 17th century (Merton, 1938). Ian Morris's work encompasses a trajectory of social development defined by the amount of energy available, organizational capacity, war capacity, and information technology (Morris, 2010; 2013). The researcher relates these elements to the current main vectors of power: 1) Military, 2) State, 3) Energy, 4) Financial banking, and mass media. The military is the most elementary of these powers due to its inherently destructive functionality above the others, military power requires energy, and the State requires military and energy. However, just because the power dynamics that war represents are a motivator of physical and social innovation; and that progress has been made thanks to the destruction it entails, it does not mean that the power of war is the only human motivation and the only way to reach progress. The fact that the progress of one part of the world is achieved through wars and the decrease of the other part, following a negative interdependence relationship (one wins what the other loses), does not mean that it is the only way to progress, there are different ways to progress where both win, following a positive interdependence relationship.

This is important because the explanation of war as the backbone of civilization is accepted as an evil that must be accepted to achieve progress. The researcher interprets that because it has been like this, it does not mean it should continue being like this because 1) War will always be on the horizon, and in current complex contexts, where interdependencies are global, war hinders progress; everyone loses in a war, even those who win. 2) an underlying dynamic describes the relationship between both technologies, between the physical world and the social world, and it is the innovation process. Innovation emerges from what interprets the physical and social world. If innovation inputs are war or negative interdependence, the output will also be war or negative interdependence.

Figure 4 considers the work of David Ronfeldt (Ronfeldt, 1996), Tribes, Institutions, Markets and Networks (TIMN), as the basic forms underlying the organization of all societies. First as kindship/tribe or extensive family structure, second as a hierarchical institution as the army or the church, third as competitive markets such as trading, and fourth Multi-Organizational Networks as advocacy groups. The difference between structures can be appreciated because of the kind of network that is configured.

7.6 Dissonance between Physical and Social Technologies

For this part of the research, the bibliographic sources that refer to studies on ecology (Müller, 1992), the analysis of civilizations by Ian Morris (Morris, 2010; 2013), and especially for the work of Paul M.M. Cooper (Cooper, 2020), an analysis of 12 civilizations that disappeared, transformed, and spread into others. Kevin Kelly based on (Festinger, 1957) refers to technological dissonance as the difference between technology expectations and technology realities (Kelly, 2010).

In ecological and anthropological analyses of civilizations (Gill et al., 2007), the physical ecosystem is shown as an independent variable, and the social context is a dependent variable since the physical ecosystem conditions or determines the social ecosystem (Muller, 1992). Contingency Theory states that the better adaptation capacity is given by the internal attributes (society) aligned with the external context (Scott & Davis, 2000), reinforcing this independent/dependent variable relationship. However, as in the example of the Khmer civilization, it can be seen that the social context conditions the physical context in the instance of overexploitation (endogenous factor), which is also a dependent variable. The Anthropocene would also be an example if the hologrammatic and recursive principles are considered (Morin, 1994; Kaspary, 2014); both contexts are dependent variables because there are relationships between open systems. Contexts are multiple physical and social ecosystems; the systems mediate with other systems (Fig. 12). The physical context system is compounded by multiple physical systems, defining different physical contexts. The social context system is compounded by multiple social systems, defining different social contexts. The hologrammatic and recursive principles relate social and physical systems.

Ian Morris argues that the elements that lead a civilization to collapse are climate change, uncontrolled population movements, epidemic diseases, and the falling of the State or trade routes. However, he also points out that it should not collapse because civilization has these elements since, in these situations, history shows that if there is a good leader or a strong economy, or violence is controlled -without episodes of violence- then societies do not collapse. There are crucial factors that affect the physical context, exogenous, such as changes in climate and geographical factors, or endogenous, changes that arise as a result of social action. In large groups of individuals and societies, according as complexity is added through technologies to gain control and security in the context, it loses resilience in the face of a sudden change in the context, motivated indistinctly by exogenous or endogenous factors. The gregarious human factor is the essential element of survival, but large structures or complex forms of organization neither are not very resilient to sudden contextual changes, whether caused or not by man. This phenomenon coincides with Bounded Rationality (March & Simon, 2005) since it is observed that if an institution is more prominent, it is more difficult to be agile in front of a sudden change in the context.

Unlike cognitive dissonance or technological dissonance, where dissonance is between actual and expected cognitive systems (Festinger, 1957) or between actual and expected technologies (Kelly, 2010), the researcher considers that there is a dissonance between physical and social technologies in contexts where technologies are deployed. Dissonance is the result between the expected and the actual and arises when social technologies (ideal) fail to respond to the complex physical and social ecosystems in which they operate (actual). When the complexity of the context embraced by physical technologies exceeds the capacity of social structures to respond effectively, they may tend to chaos and potentially undergo transformation. While many factors influence civilizations' collapse and transformation, the cumulative effect of these factors ultimately leads to their decline. Based on Cooper's examples (Cooper, 2020) and Tainter's arguments (Tainter, 2006), the researcher suggests that dissonance is a common element in these factors. Specifically, it is the mismatch between human perception/actions and the complexity of the context that leads to dissonance. Whenever there is dissonance between the physical and social contexts, there is a tendency towards chaos, collapse, or entropy since the social context cannot adequately respond to the complexity of the physical context. In other words, social technologies are insufficient to manage the new complexity of the new context, whether physical or social.

Physical technologies change the physical and social contexts, and social technologies respond to these same contexts and change them too. It is a recursive process (Morin, 1992) at a time when physical technology creates a very complex ecosystem, and social technology cannot respond to this complexity; the set falls, the system fails, and the recursivity breaks. For example, the Khmer civilization employed zero in mathematics and developed extensive and complex irrigation systems for their time. This allowed for a greater capacity to produce rice and food by means of an advanced irrigation system, which was essential for progress in that region. The social organization of that civilization was centered around a king who was linked to the divine, with temples serving as the focal point. Each temple was governed by a family of clerics who collected taxes, primarily in the form of rice, and managed resources. These taxes were then filed to the king or Jayavarman. In the festivals the king celebrated, the temple that bestowed to the king the most tributes received the most privileges and status. This encouraged not only competitiveness and power struggles between the different temples, which transferred this stress to the peasants, but also more overexploitation of resources, economic and social tax burden, shortages due to overexploitation, inequality, together with the impossibility of maintaining the complex infrastructure of water for the rice. That civilization collapsed, leaving the remains of Angkor (Cooper, 2020).

This example assumes that societies tend to control the physical contexts by means of physical and social technologies and shows a form of social technology based on a magical perspective, which interprets and explains the physical context through it. With a centralized power in the figure of the king, who embodies the representation of the magical scheme of the social context. When there is a shortage of food and discomfort, the king loses all legitimacy, regardless of whether he is a friend and talk or relative of the Gods, he has done wrong, and the Gods make it known with the punishment (no food and famine). When the physical context does not conform to the expectations of the social context, the shared frame (Lakoff, 2002; Bankler, 2011), the social technology cannot give an explanation to the physical context -there is a dissonance between expected and actual-. And the social context changes to respond to the physical context. Conversely, if the form of social organization that explains the context, that defines the norms and their relationship with it, that creates the social context, does not conform to the requirements of the physical context, cannot explain it (control), that organization or civilization cannot it persists, falls, and probably transforms.

In Jayavarman's example, the social context was organized by means of a common scheme (magic) to respond to its interpretation of the physical context (of what they saw). When the social context does not correspond to what is seen, there is dissonance; it makes no sense to continue that social schema, social organization (social technology), there is dissonance between the social context (social technologies) and the physical context (physical technologies). The king loses legitimacy when there is famine and discomfort. And when a king falls, if the famine continues, no matter how many kings follow one another and power struggles, if they do not respond (control) to the physical context, they do not give a plausible and satisfactory answer, they will continue to fall and collapse. Cooper suggests that collapse was conducive to establishing new forms of Buddhism, which were widely accepted due to the inequality that this civilization generated (Cooper, 2020). These "new religions" (social technologies) articulate a new social context (thru social technologies) with greater power to explain its relationship with the physical context (thru physical technologies). Dissonances between social technologies and physical technologies derive not only towards entropy but to innovation. The balance reached by a system compounded by different elements seeking an equilibrium is called homeostasis (Wiener, 1948).

7.7 Social Innovation

Firstly, social innovation is understood as a phenomenon that has been present in the evolution of human societies; as has been observed so far, civilizations are the result of human innovations (Simms, 2006). And also, from the prism of this research, to fix the constant dissonance between the ideal and the actual context (Festinger, 1957).

The perspective that describes the innovation process resembling a process of change is also considered, but instead of having weight randomness (evolutionary component), have weight intentionality and human rationality, a sequence where there are also mutations; it has a human filter. Defining then the evolutionary principle of technological innovation as an iterative process of 1) experimentation, 2) selection, and 3) amplification (Beinhocker, 2006). Although rationality is probably not one of the main components explaining human action, the process described by Beinhocker is consistent with the technological development seen in Fig. 4.

People live in different spaces, in cities or towns, in groups of friends, in families, with physical constructions and architectures, and also with social and individual constructions. People create ways to organize better and manage complexity, social technology or institutions to control hunting, agriculture and resources, consensus, health, education, or pleasure. A system of systems has been created, a set of machinery and gears, which, although they have allowed society to progress and advance, generates a lot of poverty, social exclusion, alienation, inequality, discrimination, and severe damage to physical ecosystems and biodiversity[10] (externalities).

The set of physical and social technologies adds complexity as it develops (solves some and creates others). Social innovation is a deliberate action to respond to this complexity, and it offers solutions that enable social change to address these externalities (Mulgan, 2006). Social innovation is based on the analysis of social change; it seeks social improvement through change, through a more resilient and sustainable society, with the capacity to respond to humanity's challenges. This is why social innovation is applied at all levels, both individually and collectively, in the city or a town, in a government or a neighborhood association, in a cultural community, in an aid center, or a nursing home. Social innovation is applied in all human social forms to correct these externalities and achieve better levels of collective human progress. Social innovation is looking for the promotion and development of a new way of proceeding collectively to achieve the objectives, focusing the analysis on the change of behavior and the transformation of habits. Javier Bustamante defines it through ethical vectors: a) community knowledge and innovation, b) citizen participation and democracy, c) dialogue between widespread knowledge and scientific knowledge, and d) holistic pedagogical process (Bustamante, 2013).

As Giovany Cajaiba-Santana points out, social innovation is explained by two perspectives: structuralist and agency, which create a dichotomy between action and structure since the agency is voluntarist and the structure is deterministic (Pierce & Delbecq, 1977; Cajaiba-Santana, 2014). Same author adds that social innovation is based on collective actions that take place within a given social system, which underlying institutions determine. And the historical and cultural context in which social innovation occurs is an essential consideration in understanding

[10] As will be seen later, interdependence relationships follow a feedback scheme in open systems (positive or negative); the researcher then infers that current environmental problems caused by humanity are evidence of negative feedback; these are consequences of poor social organization.

its processes since it is situated historically and culturally. And this is why social innovations are contextual (Osborne, 1988; Hung, 2004; Cajaiba-Santana, 2014).

1) From an institutional perspective, social innovation is shown as a result of the exchange of knowledge and resources by actors mobilized through legitimized activities.
2) From a structuralist perspective, social innovation is socially constructed as individuals collectively engage in purposeful actions and reflexively monitor the outcome of their actions.

The thesis sustained by Cajaiba-Santana argues that social innovations "are new social practices created from collective, intentional and goal-oriented actions that aim to promote social change, through the reconfiguration of how social objectives were achieved" (Ibid.).

Bustamante's perspective is fundamental to a complete understanding of social innovation: defining social innovation as a set of techniques that transform interaction with the population, representing solutions for social inclusion and the improvement of the well-being of the community. It must promote the inclusion of individuals in the innovation process; they must participate in the progress. He also points out that learning and participation go together, so social innovation becomes social empowerment. In addition, he notes that the social transformation resulting from social innovation must understand reality in a systemic way. And also, that in it all community members must be able to learn, contribute knowledge, and enrich themselves from this process (Bustamante, 2013).

On the other hand, when analyzing the dynamics of innovation, it is found that it arises from a triple helix (Etzkowitz & Leydesdorff, 2000), a relationship between three institutions: academia, industry, and the State. These institutions channel and orchestrate innovation differently; this difference is based on the interdependence of these three actors over time, currently having a high interdependence (III in Fig. 5).

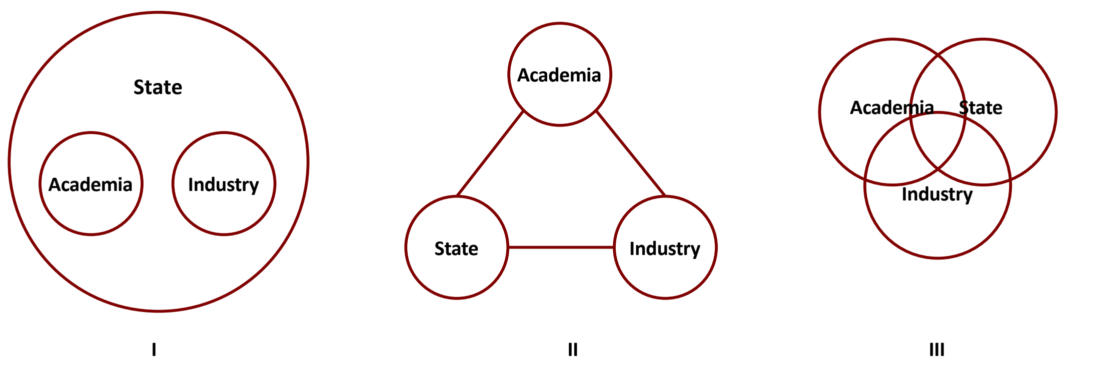

Figure 5. Diagram of innovation dynamics through the relationships between the three actors, State, academy, and industry (Etzkowitz & Leydesdorff, 2000).

It is observed that over time greater innovation is generated due, first, to the creation and then to the conjunction of these three actors, ending up feeding a process of innovation upon innovation, accelerating rapidly (positive feedback). It is an example of the formal institutionalization of social innovation. As seen in the previous section, the dissonance between the ideal and the actual can be one of the motivators of social innovation; society organizes itself by means of social innovation to reach the perception of the ideal because the ideal implies minimizing the externalities. The researcher considers social innovation as a process to develop social technology, to innovate is part of human being.

7.8 Determinism

Firstly, as seen before in the technological perspectives section, determinism is the main critique of the technological approach (Tenner, 2010). An example of the positivist vision of technology is the work of Kevin Kelly (Kelly, 2010), and the social effects and transitions can be found in the work of Sherry Turkle (Turkle, 2011)[11]. As a recursive relationship between social and physical technologies (complex thinking, see Morin & Pakman, 1994), the conception of this research implies that the normativity of the tool is not by the technology itself but by the conceptualization and use of who creates and uses it. A calculator (physical domain) and the science (social domain) behind an atomic bomb (physical domain) are not normative (social domain). Normative is using a calculator and the required math to conceptualize and use an atomic bomb. This latter is an example of an extreme case, but more common cases can be found in Ben Goldacre's book Bad Science (Goldacre, 2009).

Secondly, according to the principles that define living systems' behavior, Simms hypothesizes that: "the technical and social innovation of the first civilizations supports the hypothesis that innovation is a fundamental determinant of human behavior. The determinant of innovation directly affects human behavior through previously identified and quantified determinants of individual and group behavior" (Simms, 2006). As far as it has been analyzed in this research, this characteristic has also been observed[12]. In addition, innovation helps humans embrace complexity and not be determined by one area of context complexity.

As Schumpeter (McCraw, 2013) points out, innovation has always had a technological component, and if the summative effect of innovation, technology, is also considered (Fig. 4), this technological determinism can be found. Bunge's work considers the role of causality in modern physics, interpreting that the world, although it is deterministic, is not strictly causal. Determinism implies "legality" because it must follow specific laws. No events are constrained by natural laws, but those laws are not causal (Bunge, 1959). This determinism should not be confused with the fact that there is only one way of progress, dystopia exists and can continue to exist. Thus, this determinism of progress disappears if one of the physical context variables

[11] The analysis considers the reflection of both books (Eric Bain-Selbo, 2013).
[12] We are more than the result of the sum of innovations.

changes, such as running out of water or energy. That would generate a change in social technology, different from what it would cause if it found an energy source with greater capacity than oil. In the scheme shown in Fig. 4, the progression is accentuated, which increases logarithmically, especially when new forms of energy and efficiency (like machines) are discovered; it is shown as a historical continuum, even if it could be done "zoom," it would be observed that it has not always had an upward trend.

It is critical to the reflection made by Javier Bustamante: "Innovation has strategic importance for sustaining a society based on the expansion of globalization at all levels and on the association of social change with technological change. Although there are various ways of understanding how technology and society interact at a causal level, theories of technological determinism have been imposed de facto, which place social change as a variable dependent on technological evolution, with all the ideological discourse that entails" (Bustamante, 2013).

The methodology is based on recursivity as one of the principles to understand complexity, so the researcher understands recursivity as a constant element between technologies but determining that there is a recursive process does not imply determinism in what recursivity effects. There are mechanics and processes and many cognitive systems - individuals- that affect or condition recursivity. Recursivity is a deterministic process, but its effect is not.

Bustamante adds: "Today, no one doubts the reductionist nature of a strong technological determinism, which makes technology an independent variable and an efficient cause of social change, but the belief in the determining role of innovation for social welfare, and the identification of innovation with technological change, constitutes an (almost) unique thought that reduces the universe of discourse and limits the scope of action of a society that needs something more than faster and more efficient ways of performing the same tasks without a real questioning of the objectives that these tasks serve, without undertaking a necessary reengineering of the processes" (Ibid.). The technological approach discussed in the following sections will explore technology to improve efficacy. In addition, innovation has a functionality, which not only has an aim oriented towards an efficiency process, a market, or an industry but also, as Bustamante says, for an ethical purpose (Ibid.). And in this dissertation for a dissonance.

7.9 Complexity Dependency

As said above, Beinhoker describes technological innovation as an evolutionary process, but instead of randomness weight, intentionality, and human rationality (maybe normative) have more weight; where there are also changes, but they have a human filter. This technological evolutionary principle is defined as an iterative process of experimentation, selection, and amplification through deductive logic (Beinhoker, 2006). This technological process between physical and social technologies entails a positive feedback loop of innovation and adds complexity. A characteristic element of technology is the premise that technology applies to prior technology; new knowledge is applied over old knowledge. The technology builds on old technologies (Kurzweil, 1999); creating a projection of advances on advances that follows a logarithmic form (Fig. 4) since it is the sum of technologies that follows an exponential projection, evidencing a positive feedback loop (Kelly, 2010). At the same time, the recursive principle is appreciated, which refers to Morin's perspective of complex thinking.

The complexity flourishes precisely from this premise, and the counterpart of this axiom is that by applying that technology, it becomes dependent on that one. Norbert Wiener, in 1948 explains in his book Cybernetics and Society: "We are the slaves of our technical progress, and it is so impossible to return to a New Hampshire farm, living in it according to the autarkic methods of 1800" (Wiener, 1948). A more characteristic example can be seen in Guns, Germs, and Steel (Diamond, 1999), where the author shows that humanity becomes dependent on agriculture the moment humanity invents it. Simms shows that this discovery also represents a behavior change (Simms, 2006), gives them greater control of the context and security, and allows them to make the first forecasts to feed themselves and build enclaves and buildings, improving the group's survival. The land becomes a strategic element, from an uncontrolled element to a more controlled and stable one. For the first time, control of a site was established (sedentarism), something very different from the conception of the collector-hunter groups. So, each enclave has different characteristics, and there are better and worse enclaves; the geographical variables (systems) conditionate and determine humans (systems) (Fig. 12).

The characteristics of the environment define the enclaves, and according to the interpretation of the physical context, essential to adapt to an environment, the forms of social organization flourish. A social context is articulated to respond to a physical context through physical and social technologies. With technology, a context is adapted and controlled, but a more complex one is created, with more variables to control. The controlled area of complexity is expanded, but the area to be controlled is also extended.

7.10 Technology and Energy

Agriculture is a technology, and electricity and the internet are too; Pry states that if electricity were to be removed from society today, approximately 90%[13] of the US population would die just in the first year (Pry, 2017). Without the electricity needed to pump water, synthesize medicines, or transport food, today's Western society would likely collapse. All technologies derived from electricity would cease to exist, and the social structures created based on this technology as well.

The researcher considers that there is a close relationship between progress and energy, especially technologies that involve energy transformation, and it has already been mentioned

[13] The example from Pry's study is based on the consequences of an electromagnetic pulse (EMP), which burns any electrical circuit, destroying all electricity-based infrastructure.

that both Meggers (Meggers, 1955) and Leslie White (White, 1959) proposed that societies as thermodynamic systems are subject to the laws of physics (Gill et al., 2007). Affirming that when a system requires energy for its subsistence, at the moment the energy falls, the drop of the system is established below the sufficient energy threshold to maintain its subsistence. Also, Ilya Prigogine states that a hierarchical social system requires a stable and robust energy source to organize itself. But always, if the energy flow is broken, the system collapses to the point where the level at which the hierarchy can be sustained with sufficient energy (Prigogine, 1980).

At the same time, a linear increase in energy can produce a non-linear change in the system that drives it. The analysis speculates that the invention of agriculture was a process of energy transformation of the system; in other words, agriculture brought about a considerable change in the energy management of the whole, which also influenced how to organize. According to the previous speculation, this energetic change follows social empowerment (progress) and a logarithmic relationship between the physical and social technology dimension since physical technologies are the substrate for developing more social technologies and vice versa. As seen later, considering the Theory of information (Shannon, 1959), information is energy, and the technologies related to information could also be considered energy transformative. The investigation has not delved into the consequences of a hypothetical fall sustained on the Internet, but this would probably cause a substantial change in social organization forms and a collapse of the economy and current politics. Technology creates a relationship of recursion and dependency; all dependent technologies will disappear when that technology disappears. With current knowledge, the population, and resources, it would not be possible to go back to the 1980s; fitting the same "frame" that existed then, it cannot be downgraded in energy technologies easily.

This can be seen in the example of the fall of the Roman-British civilization (Cooper, 2020). It starts from a social organization with an economic structure based on self-governance and exchange between clans. However, with the entrance to the Roman Empire and the Roman roads[14], its economy became more complex, and it was subject to more than just the exchange of local products between lands. It was based on selling "global" products, mainly from the other part of the Roman Empire, thanks to an infrastructure of routes and "security" given by the Roman Empire. They had left behind a purely local and more straightforward economic form that was circumscribed as an island and created a more complex economic and social structure. Nonetheless, when the barbarian invasions eroded the Roman empire, the infrastructures that supported it and the roads that interconnected the empire were broken. That civilization, within the limitations of an island, found that it did not have its own local and sustainable economic way of responding to the new context. All that new complexity with which they were organized and sustained was only possible with the security of the routes within the empire. They could not go

[14] To the researcher, roads are considered energy technologies, roads improve interdependencies (information) between individuals and societies, just as internet does.

back, they no longer had the knowledge, habit, or organizational structure. When the infrastructure collapses, there is a generalized collapse, and the economic, political, and cultural structure falls; it fragments and submerges in an "entropy" or lack of order. The research considers the Roman-British course as an example of from local interdependencies (complex) to global interdependencies (more complex), setting a threshold of complexity, and after from more complex to less complex (collapse and transformation).

As said before, a deterministic element conditions the thesis and must be considered in this work, and it is the relationship between energy and development; systems require energy. Any action requires energy, and this follows the laws of thermodynamics. Energy consumption is increasing according to progress (Ehrlich et al., 2012); progress nowadays is standardized as GDP. Undeniably, the discovery of a fossil energy source has been decisive in the advancement of society. Considering that an individual at rest generates 90w/h-100w/h (7,100 kJ per day) Basal Metabolic Rate (BMR), and at a peak moment, it can generate 400w/h. A car consumes more than 100Kw/h, and the coffee machine has a peak of 500w/h. Educating the entire population, printing the press, achieving food security, having a Welfare State, and ensuring that an individual can move freely by car or that computers are accessible to almost everyone in EU region, are examples of innovation, empowerment, and democratization, nevertheless have required much energy.

In a world of finite resources, the problem arises if the energy demand for growth is greater than the capacity to create energy (Turiel, 2020); for the moment, an energy source has not been found with properties like fossil fuels (Weißbach et al., 2013). Without a valid alternative, peak oil (Frenkel, 2010; Elwell, 2013) could lead to technology losing its accessibility. Getting the GDP to continue growing while minimizing energy consumption, either because there is no energy or because it affects the climate, is a challenge that forces us to rethink consumption (Grant, 2011) and production relations; this involves rethinking the economy based in production and consumption regulated by forms of markets and States.

The current institutions are not well prepared because they appeared and have been developed in a very different energy context than the current one. In addition, Mauro Guillén remembers that revolutions have been carried out thanks to water and energy (Guillén, 2020); if there is no energy, there is no change, and there are no revolutions. As a thermodynamic system, if a new energy source were discovered[15] (new energy transformation) that would allow us to continue promoting the human projection that is described throughout this dissertation, in that case, the water problems could be minimized, and humanity could continue to progress. If not, a degrowth path like the one proposed by Serge Latouche (Latouche, 2012) or Carlos Taibo (Taibo, 2020) should be considered.

[15] Apparently, we are living the early stages of an energy transformation.

7.11 Reflection

To the initial definition of technology, the research adds that the use of technology is to minimize risk by maximizing control of physical and social contexts. Human beings create technologies to manage uncertain and complex ecosystems, regardless of whether these contexts are physical or social. Creating technology arises from innovation; this allows control of a greater ecosystem and a greater field of uncertainty or risk. Social innovation builds social technology as physical innovation builds physical technology. Technologies also change contexts, modify them, and create greater complexity, a process of technological feedback to improve greater physical and social control of ecosystems. It is a functional definition, technology has a function, it is not a resource found in nature per se; it requires an intelligent entity that knows how to combine the different existing elements to create this new resource.

Innovation is now more outstanding due -among others- to the fact that there is a more significant interrelation between the different institutional actors that promote social innovation; the "exponentiality" of technology (Hanson, 2008) denotes that it follows a process of positive feedback (Kelly, 2010). This process creates an axiom and determinism since these actors devise physical technologies and organize themselves to develop these physical technologies using social technology. The relationship between physical and social technologies is recursive and hologrammatic (Morin, 1992; 1994).

The researcher points out that the dissonance between physical and social technologies tend to cause entropy and collapse, but at the same time, this dissonance is a source of innovation. Physical and social technologies change contexts and the understanding and explanation of what surrounds us; when social technology cannot understand (control) or explain the new context defined by physical technologies, there is a dissonance between the expected of the organization and the actual. Society is organized (social technology) according to how we understand the context defined by physical technologies. When the organization cannot understand and explain the new context defined by physical technologies, there is dissonance and a change in social technology.

The feedback loop of the technology is positive; this is technology on technology; if there is a dissonance between physical and social technologies, it will probably induce a regime change, a new state of operation. Excess positive feedback loop tends to change; the negative feedback loop maintains order (Kelly, 2010). The emancipatory technological processes are characterized by 1) the solution's efficiency, 2) the greater interdependence it grants, and 3) the social empowerment (positive externalities) according to this interdependence's feedback type.

Laws of thermodynamics condition social systems; social change requires energy, and in the process of energy transmission, some energy is lost and tends to entropy. The path of progress that has led to the current context has needed much energy to develop physical and social technologies. Even when immersed in the process of increasing efficiency, today's society requires large amounts of energy for its development. Getting every human on earth to have equality of well-being and control of complexity requires a lot of energy. The researcher does not know if an energy source will be obtained in the future that will allow these levels of progress to be maintained and achieved. If democracy is a more decentralized form of power than autocracy, it handles complexity better, although it requires greater energy to sustain itself (it is less efficient but more effective). The researcher speculates that in a context with limited energy, democracy may be threatened while autocracy would likely be promoted.

Society is not resilient in front of a change to a previous energy state, the current institutions have been created under a paradigm of abundant energy and not energy scarcity. The energy problem and the oil peak can describe neo-Malthusianism; the various authors who point to this problem infer the future through current technologies. Future technological innovation is a progression between physical and social technologies so it will have new technologies to control the contexts. Malthus did not expect technologies to help control contexts, feed the population, and better organize themselves (relationship between physical and social technologies). The researcher infers that innovation is the act of creating new technology, regardless of whether it is physical or social, where social innovation is a broad phenomenon that government agencies and private initiatives can lead, motivated by civil society in particular historical contexts, but it is a phenomenon mainly driven by social entrepreneurs (Mulgan et al., 2007). However, government agencies or private institutions were social innovations in their moment and replaced others because they offered more efficiency, improved interdependences, and better positive externalities. And this does not exclude that the new ones who control these innovations use the power in their favor and define the new hegemony.

8 Technological and Social Transition

The previous section shows Ogburn's statement that when people use an invention, the social effect is usually greater than the arithmetic sum of individual habits changes. Individuals' habits change because they are organized through an institution (Ogburn, 1947). The research infers that exogenous and endogenous factors affect the change of habits. The technological perspective shows a part of the explanation, where there are mechanics and processes and where the power of technology defines how politics will be. This section focuses more on the forms of organization of complexity from analyzing societal changes. The analysis is based on the relationships between social facts and technology. When exploring societies and civilizations and their technological transformations, the mechanisms, processes that are incurred, and episodes have been kept in mind to detect recurring patterns (McAdam et al., 2001) as well as the motivations as the connection elements (groups of motivations that come together and energize the group of individuals).

In this way, an analysis of change is covered as a set that is distinguished by: a) individual change, b) the oscillation between centralization and decentralization c) power and monopolies, and that leads to d) regulation or control of interdependence. Essential aspects of understanding the definition process of States, thanks also to e) nationalism. And it is for this reason that the analysis later focuses on f) the agreement of individuals with the State and the social contract to finally understand g) the social dynamics and its relationship with the State through h) repertoires of contention. In this part of the dissertation, an analysis of the i) relationship between the human and the machine is carried out. Eventually, j) see the change from the Conflict Theory perspective.

The analysis comprehends the actors involved in the change process and the powers of each one and pays particular attention to linking technology to creating these new agents/actors. The study of the transition from feudal times to modernity is given initially by Leslie White and his work on cultural evolution and technological changes in that time, as well as by Norbert Elias, through his analysis of the civilization process, and Max Weber, which complements the study of the changes and progress between the different European territories. The researcher interprets the work of the various authors as evidence of the change process in social technologies, in how they are configured and updated to respond to the new contexts they create, or, how they assimilate complexity and create new limits of complexity.

Regarding the analysis of revolutions by Charles Tilly, one can also observe the creation of organizational identity, which is also related to the aspects of identity that Haas refers to through nationalism. The dissertation interprets that to explain the political form, the causal arena of the mechanisms lies not only in the individual's mind but basically in the social interaction, in the type of interdependencies; the kind of interdependence and feedback defines the policy.

It must also be said that, in this part of the work, the vision of Hobsbawm has been necessary, who questions the properties of the elements that affect modernity and defines the term dual revolution: Modernity is defined by the fusion of an ideological and political revolution, and, a technological and industrial revolution (Hobsbawm, 2010). It also confirms the recursive relationship between physical technologies (industry) and social technologies (politics).

This section has an essential aspect about technological transitions and their consequences. It is the implicit character of the progress in knowledge throughout this analysis of social change. The fundamental conception of reformist movements and enlightened social criticism is the improvement of institutions, education, and laws. And this is achieved thanks to the progress of knowledge (Elias, 1938). Knowledge and science are pillars of physical and social technologies; they allow innovation to be created on top of existing innovation. This links to Bustamante's notes in the technology section when he refers to knowledge communities (Bustamante, 2013), which are related to the changes described below.

It must also consider Barrington Moore, who analyzes the transition trajectories from agrarian societies to industrial societies. He describes three trajectories: a) capitalist democratic route. b) reactionary capitalist route. c) communist route. The differences reside in how the relations between the new social class, the bourgeoisie or industrialists, and the previous ones (farmers and aristocracy) were founded, affirming that without the bourgeoisie, democracy had not have been established. (Moore, 1966). A priori, it may seem that democracy was the way to remove the power from the kings by the new bourgeois/industrial class.

As said in the technology section, this new power dominates technologies that surpass the technologies held by the hegemonic power of that moment (Frey, 2019), such as capital, knowledge, or machines. The explanation is coherent if one considers the situation of English merchants paying tribute to some noblemen who lose the wars against France. Moreover, they decide that they are not going to give more money if they cannot make decisions about how they are going to spend their money. Beginning in 1642, the First English Civil War between Charles I of England and Oliver Cromwell, -represented the struggle between the (old) monarchical power and the (new) parliamentary power, the stage of the revolutions that went from the old regime to republics and liberal states. Democracy (social technology) becomes an instrument of power for new classes; simultaneously, it is more efficient and efficacy to handle further complexity and grants empowerment and greater interdependence. Frey points out that industrialization was the key element that created and shaped the middle class (Ibid.). So, society is redefined according to a new reality, with newly added classes, bourgeois and industrial, and the proletariat, which later passes to the middle class and with a connotation of freedom and identity of the individual hitherto unheard of (European conception).

8.1 Individualization Process

It is initially observed that there is a process of individualization even before the entry of modernity, as Elias exposes, the feudal system contrasts significantly with the tribal system. With its dissolution, new integrations and forms of grouping appear. Individualism experiences a great impulse, strengthened by mobility and the expansionist tendency of society. It is an individualism against the tribal organization and, partially also, against the family organization, just as, later, there will be a new advance of individualism against the feudal organization, the union organization, the State organization, and, again in front of the family organization (Elias, 1998). The individualistic tendency comes from a long trajectory and has a tendency to increase.

To understand this process, the work starts from the theoretical basis of Max Weber's individualism; it also considers the studies on individualism by Geert Hofstede and Gorodnichenko & Roland, which will be seen in the section referring to strategies and context, observing that although the advantages of collectivism increase the static efficiency of the economy, the benefits of individualistic culture increase dynamic efficiency and therefore long-term growth (Gorodnichenko & Roland, 2011). As well as Ulrich Beck (Beck, 2003) or Crawford Brough Macpherson and the possessive market society (Macpherson, 2010).

Based on this set, the researcher speculates that technological tools would allow less dependence on the collective for the individual. This may be related to the effects of the Welfare State (WS) on individuals in Scandinavian countries, where the WS and the markets offer so much protection that it tends towards an atomized and, in many cases, depressed society. In such a way, the markets and the WS, although these are forms that allow greater interdependencies and progress. At the same time, atomize the individual and make them less dependent on their social context. In other words, technologies supplement social interdependencies. Individualism and freedom are related concepts; the more pronounced individualism, the greater the degree of freedom. Bearing in mind the technology section, both are linked to empowerment; it can be derived that technology is more likely to develop freedoms since a less risky and more controlled ecosystem allows an individual to move with more unrestrained action.

8.2 Centralization and Decentralization of Power

Another aspect that stands out about the transitions of the forms of governance is that there is an oscillation between centralization and decentralization. In the forms of centralized government, the kings were forced to decentralize their power in the different regions with their representatives; the economy was based on the land, and the King paid with the land. The representation of the paladin counts or other illustrious forms, such as marquises or dukes, was nothing more than hereditary forms that, over time, claimed those territories as theirs. The kings had to deal with all the revolts of those responsible: "The greater the factual power and the economic and social strength of the delegates, the less the King could dare to their death, to grant the position to a person who was not from his family" (Dopsch, 1924).

Regardless of whether they were feudal lords, administrators, or representatives of the central power, they sooner or later found themselves at the juncture of their social and resource independence; in other words, if that territory manages itself and defends itself correctly from the rest of the regions, it will not a King is needed, a central power, who also submits taxes for his benefit. Thus, power struggles within the kingdoms were day-to-day in the Middle Ages, meaning that the kingdoms were always managing internal crises and wars. It is appreciated that as interdependence increases, complexity increases.

Elias refers to centripetal forces and centrifugal forces to refer to the processes of centralization and decentralization, and he uses the example of the principalities to annul the hereditary nature of the forms of governance and counteract the decentralizing dynamic, understanding that if the representatives are clergy, there will be no decentralizing trend. "Nothing is further from reality since these actions strengthen this decentralizing dynamic" (Elias, 1998).

There was no modern economic way or modern bureaucracy to control the acquired land, as has been said, the king paid with land, and the way he had to control the land was through the usufruct of them to third parties; we know that this process is called feudalization. During feudalism, there is no complete way to control the territory; the social force is based on war -politics is also a form of social force- (Weber, 1978). This context strengthens the discrepancy between the "Havers" and the "Have-nots." Progress and development were established based on these forms of organization, a relationship characteristic of supply and demand, between those who offer protection and land and those who provide services or work on the land (Elias, 1998).

This "balance" begins to break as complexity increases since the form of social ascension is through war and the looting of fiefdoms. This same dynamic can be observed in Padisson's book, The Fragmented State, where this process of decentralization or localization is called a sub-state or sub-government. Padisson affirms that currently, the federation is the most decentralized form of State and that for common processes, all the federations grant their power to a central entity, creating a confederation (Padisson, 1983).

Regardless of the degree of centrality, the mechanics are based on forms of domination, monopolistic mechanics, the goal is to achieve a monopoly; if one has a monopoly, one has more possibilities of social permanence. "In other words, it approaches a situation in which, through accumulation, a social unit ends up reaching a monopoly position over the power opportunities that are under discussion" (Elias, 1998).

8.3 Monopoly and Power

Elias (Elias, 1998) as well as Weber (Weber, 1979) and Rothbard (Rothbard, 2009) are very clear about the conception and mechanics of the State to organize monopolies. Modern society was determined by the monopoly mechanism, eliminating the possibility that free or noble individuals can exercise military power, leaving this reserved only for the new central power, like the concession to collect taxes on property or the work of individuals.

In such a way that the monopoly of violence and the fiscal monopoly fall on the central power simultaneously, there is no one before the other. The model is a permanent administrative apparatus dedicated exclusively to managing monopolies. From this moment on, the objective of the social struggle is not the achievement of a military or tax monopoly but the control of the administrative power of the monopoly. These two monopolies are the basis for creating other monopolies, but these two are essential. If these two monopolies collapse, the State falls (Weber, 1978).

It can also be appreciated that the concentration of production factors Marx referred (Marx, 1979), or E. P. Thompson (Thompson, 1979), among others, responds to the customary monopolistic practice of power and was not unique to the bourgeoisie or industrials, in the sense that monopolistic practices were a common attitude of power along history. "Successful combatants see their opportunities increase while those of the defeated diminish. More and more power is concentrated in the hands of one part of those who originally started the fight, while the other part is excluded from the direct competition fight" (Elias, 1998).

Weber's work in Economy and Society summarizes monopoly and the consequences of creating closed opportunity systems. He shows that the monopoly situation occurs when the smaller social units give rise to a larger one thanks to their interdependence, have relatively equal strength, and, consequently, can freely compete to achieve better opportunities for social strength, that is, above all, to achieve the means of subsistence and production. "There is a great probability that some of those units will triumph, others will succumb, and that, consequently, fewer and fewer will have the best opportunities, each time a greater number of units will be excluded from the competitive struggle, units that fall into a situation of direct or indirect dependence on a diminishing number of winners" (Weber, 1978). "The network of human beings immersed in this movement is getting closer, therefore, to a situation in which the power of factual disposition over those opportunities that are at stake is concentrated in a single hand. In this way, from an open opportunity system, we have gone to a closed opportunity system" (Ibid.). The new production system affects traditional manufacturing first; all the subsistence elements that used to be produced by a large number of individuals are concentrated in a few hands. The elimination of the subsidiary rural form by introducing the new manufacturing industry means that the flow of capital becomes more and more concentrated towards a few to the detriment of the rest.

It can also be observed that there is a gradual decentralization of monopolies at the same time that new ones are created and with new agents. Elias mentions that with the bourgeoisie and industrialists controlling the monopoly, it achieves the distribution of the pre-existing monopolies and the redistribution of their burdens and benefits. The fact that these monopolies no longer depend on an absolute King but on a new social class is an element of social empowerment (it does not exclude that it is unfair or unequal, but it was a step). Furthermore, later, a step on the path of opportunities that provides that the monopoly is no longer exercised according to the whim and personal interests of a few individuals of a ruling (industrial) class, but according to an impersonal and exact plan, in the interest of many interdependent associates (State) and, finally, in the interest of the entire network of interdependent human beings (Elias, 1998).

Moreover, he continues: "It has already been observed that in correspondence with the concrete forms of land ownership and the instruments of physical violence, «socialization» implies, at the same time, a dissolution of the centralized monopoly, even if it is centralized in a very flexible way. This leads to the transformation of a single large monopoly ownership into a series of small monopoly ownerships, that is, into a less organized and decentralized form of monopoly. As long as land ownership continues to be the predominant form of property, new impulses in one direction or another will continue to be produced in certain circumstances, as well as hegemonic institutions in the path of free competition, integration of large territorial areas and warring masses under the dominance of a single central lord, decentralizing impulses, new competitive struggles between different layers of his servants, his relatives or his subjects of the most diverse degrees, new attempts to establish a hegemonic power. Moreover, all these centralization and decentralization impulses will end up leading to a complex imbrication of social phenomena of the most diverse diversity depending on the geographical or climatic conditions, according to the peculiar economic forms, according to the type of animals and plants on which the life of the people depends, and also in connection with the structure of the religious organization" (Ibid.).

He also adds: "This rhythm, which always threatens to cause the dissolution of the great monopoly manorial possession, is modified and ends up being interrupted to the extent that, with the increase in the division of functions in a society, the way of property, instead of being that of the land, is that of monetary means. Only in this case, the dissolution of the great centralized monopoly, with the transition of power from the hands of a lord or an oligarchy to the power of disposition of a great circle, does not suppose the multiplication of small environments of domination as it happens in the Middle Age, but this transformation, because it is decentralized, is becoming an instrument of the whole of society in which there is a division of functions, that is, in a central organ of what we call a State" (Ibid.).

The logic used so far leads to the fact that there is a tendency towards the fragmentation or decentralization of monopolies but also to a tendency to create more monopolies; if technology has an element of power, if more technologies are made, then more opportunities will arise, will generate power, and finally, the existence of more monopolies.

8.4 Regulation and Interdependence

The latter is a trend that can be seen in the current form of capitalism, which necessarily requires regulatory entities due to the derived externalities it generates (Thomson, 1979). Being the monopoly a basic element in creating the links between the State and markets, or private and public. One tends to monopolize, and the other tends to regulate, creating two powers around monopolies. This relationship is based on efficacy and efficient regulation, as seen later, any system requires regulation. If there is good regulation, the opportunity system is open; if there is inadequate regulation, the opportunity system is closed. Systems need to be well-regulated, especially if complexity arises.

The widespread inequality the world is experiencing shows a greater tendency toward concentration (Piketty, 2013). Paradoxically, this dissertation stresses that this concentration has been democratized throughout history. The researcher often observes similarities between modernity and the current era, especially in power dynamics (Greene & Elffers, 2000), showing that a lot has stayed the same (the difference is the number and diversity of powers). However, on the other hand, the current regulatory form is very advanced from any individual's mind throughout history. Although there are still monopolies that generate inequalities, it is still an indicator that regulation, although it has achieved a lot, is not adequate at all.

The management of monopolies is an essential aspect of the creation of States. According to Elias, first, it went through the private stage with the principle of the "free market" and privatization, where the existing monopolies -it is interpreted as referring to nobles or "lords"- become accessible to new agents, the new bourgeois/industrial power. Given the communal problem that this private management generates (Thompson, 1979), subsequently, more weight is placed on creating public or State monopolies from these private monopolies, as the same author says, a consequence of a function of social interdependence. The State regulates the markets controlling monopolies "It is evident that the key monopolies of domination are State or public monopolies" (Elias, 1998). This is one approach to how the current system regulates.

The force exerted by monopolies can also be seen in Tilly's work on the forms of coercion generated by States (Tilly, 1990). The researcher understands that according to Piketty's evidence, which concludes that the current form of capitalism tends towards accumulation: whoever has more, it is easier for them to have more. For those who have less, it is easier to have less (Piketty, 2013). This is evidence that the regulation is not as effective as it should be.

The value of work and capital are different; capital has a higher value than work (Institute of Strategic Studies, 2019), which already creates an advantage for those who have capital over those who only have work. Although monopolistic practices are different from those of the feudal era, and with the entry of the State, these monopolies have been able to be reduced or better controlled, monopolies still exist, but development requires sufficient interdependence to generate progress, and these monopolies do not allow interdependence. It seems clear that greater interdependence equals greater probabilities of progress (Suzuki, 1994). Elias affirms that interdependence relations between cities allow greater levels of progress and complexity, to which he adds later: "The change in behavior and affective life that we call civilization depends on the intense interrelation of human beings and their growing interdependence" (Elias, 1998).

Neither regulation by markets nor regulation by States nor regulation of markets by States seem to be the optimal regulation solution to minimize current externalities and to regulate a more complex system to cover more complex context and progress.

8.5 Nationalisms

In this transition, nationalism also crystallized, which gave greater consistency to colonialism and also promoted trade. That also offered a new sense of equality or similarity between people never seen before their irruption, also granting a new collective identity. One of the characteristics of nationalism is that it achieves a hegemonic culture, for which reference is made to Lears (Lears, 1985), who analyzes Gramsci and his vision of the forms of subordination and domination generated not only by capital but also by the State. The State spreads culture among its citizens, inferring that a greater shared culture equals greater cohesion (levels of similarity and trust).

For the analysis of the nationalist phenomenon, reference is made to Ernst Haas (Haas, 1986): "A nation is a body of individuals who claim to be united by some set of characteristics that differentiate them from outsiders, who either strive to create or to maintain their own state. A nation-State is a political entity whose inhabitants claim to be a single nation and wish to remain one. Nationalism is a claim by a group of people that they ought to constitute a nation or that they already are one, but this generic category divides into:

a) National sentiment, a claim that people on one side of a categorical boundary ought to exercise self-determination at some point in the future.
b) Nationalist ideology, a body of arguments and ideas about a nation advocated by a group of writers and activists embodying a political program for the achievement of a nation-state.
c) A national myth, the core of ideas and claims that most citizens accept about a nation-state beyond their political divisions when a nation-state is successfully created."

Hass shows that Italy was made not through a "culture war" and not through a purely nationalist movement but through a combination of political and military maneuvering, class conflict, and a variety of forms of contentious politics. Throughout all the writings of Weber, Paddison, and Frey, there is a relationship and tension between centrality and the lords of the periphery, between centralization and decentralization. The researcher considers that nationalism is the tool that breaks this tension, establishes a greater interdependence relationship, and minimizes the conflict between centralization and decentralization. Lords or kings could not confront the identity nature of the nation. The nation allows a new reality and vision where the fight between lords does not pay off; it is worth fighting for a state more than for a lord.

The historical mission of the nation, like the institutions, is to achieve its survival and protection, regardless of the means required for it. And creating an umbrella of values that generates a collective identity is a significant change at that moment. The scheme of identity attributes elaborated by Hass through different dimensions (ibid.) offers a complete image of the genesis of the "new" ideological forms. After thousand of years with a single theological ideology, with a single explanation, of understanding life and organizing based on that explanation, new ways of explaining reality and organizing appear, new ideologies and new opportunities to project itself as a society.

Haas conceptualizes an ideological scheme between a) revolutionary and b) syncretist, and from here, he creates a typology of ideological characteristics. He analyzes how each one is characterized in the definition of his vision of "the social problem" and its solution. Then, the different types of ad-hoc discourses are deduced to the solution, which will structure the ideology that will create an identity.

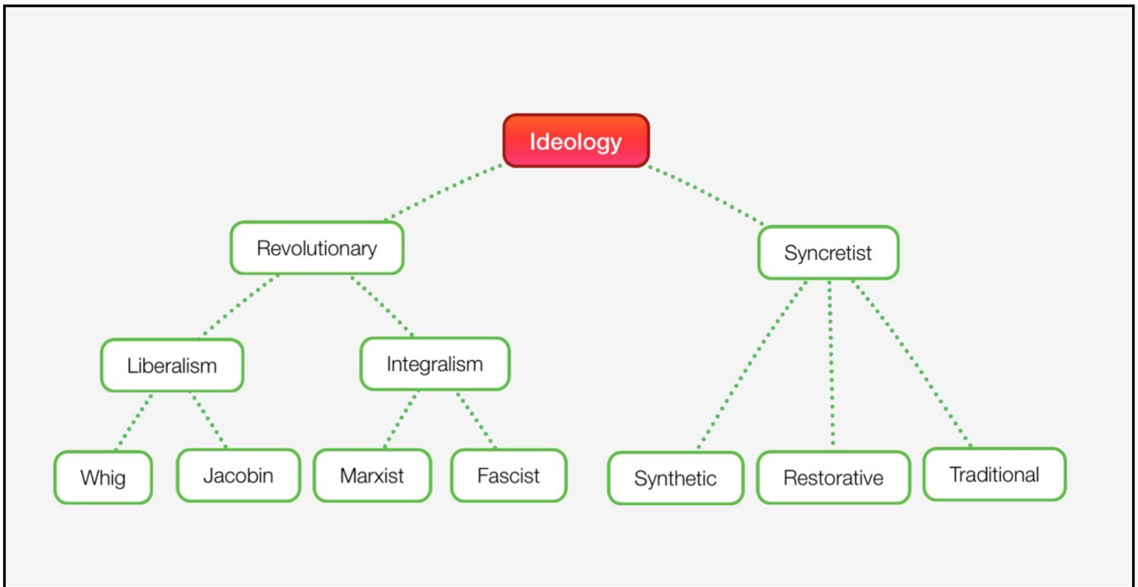

Figure 6. Hass's ideological classification. Through the characteristics that make up each ideology. Source: Own elaboration based on Haas text (Ibid.).

It is then when the fight will then happen to establish that identity as unique and hegemonic. These new ideologies are motivated by new economic factors, power interests, classes and identities, and social change. It is crucial to take into account when contextualizing all the information for reflection that, in less than two centuries, an average individual finds himself: 1) an agricultural transformation, 2) an industrial revolution, 3) the passing of superstition to reason, 4) from the fief to the State and markets, 5) from a king or lord to a parliament of democratic conception, 6) from an economic system based mainly on war and land to one based in the capital, 7) of a serf identity, an identity of freedom and with rights. There are many changes in a short time, which, although they show a progression, social progress, are also an example of blood and suffering, and are also an example of the future shock, or what are the same, too many changes in a short time. (Toffler, 1970).

Nationalism, through symbols, as Hass says, creates and delimits a framework of rationality, a framework that has a limitation in physical space, which is defined by the locality. This rational framework differs according to the ideological attributes that support it and the various meanings of values typical of each culture and region. This rationalization is given by the nature of different elements that make it up: 1) Creation of the myth on which the framework of rationality is based. 2) Definition of times for social mobilization. 3) Definition of the differences of the division. 4) Distribution of space. And 5) nationalist ideology as a motivator.

It is also important to point out how the amalgam of nationalist ideologies takes values and positions from other sides (syncretism), which may contradict different values of their own ideologies. Furthermore, nationalist myths contain claims about other nations, even after achieving national self-determination. The fundamentalist myth suggests contention, insecurity, and constant struggle. The Jacobin variable of the liberal myth legitimizes the imperialism of the virtuous, even if it stops at accepting the inevitability of international struggle. "Synthetic" syncretism is peaceful, but the other two varieties of syncretism are ambivalent about relations with other nations (Hass, 1986).

The researcher comprehends that, in this amalgamation of nationalisms, each one defines a rationalization scheme, for the control of the territory and the resources of that territory, in a colder and more organized way than in previous times. Still, basically, it follows the same objective as in earlier times (war) but with a different dynamic with greater interdependence. This is part of the process of rationalizing war and violence, granting the legitimacy of the monopoly of violence to create the State. It has coherence with the historical research analysis and Rousseau's[16] statement that happiness at home is paid for by unhappiness outside. That shows that the problem of nationalism escalates abroad, exercising laws of domination towards other sides or regions, and that allows a better legitimacy of using war to control territory.

In addition, the characteristic of division, exclusion, or the creation of factions that the concept of nationalism inherently has, sooner or later, causes this segregation, inequality, disparity, or division to escalate the conflict. Once a differentiation has been eliminated, another characteristic element of differentiation is sought because there must always be two sides to maintain cohesion. A characteristic that also appears in the Tª del Homo Ludens (Huizinga, 1950) where it is necessary to create a factor of division, a differentiation that moves the competition (agon).

The analysis infers that nationalism, or the powers that be nationalism, use this divisive feature for their benefit. It is an act of influence, where a few influence many for the objectives of those few. This inference arises based on Lukes and his definition of the third dimension of power (Lukes, 2007). Lukes understands power as a capacity but not as exercising that capacity. The third dimension refers to the influence that A exerts on B so that B's desires are the same as A's, even though these desires are counterproductive for B himself. Something that can also be observed in the perspective of power offered by Greene (Greene & Elffers, 2000).

The rationality of nationalism is delimited by ideology, which always creates its regulatory framework according to the rationality that suits the nation. "Rationality" is different in different nations. The research infers then that rationality is variable; it can change in time or space, it is an attitude, observable through habits, and that probably has a part of explanation through power interests. It is also essential to comprehend the identity that the locality grants and that nationalism uses; concentric spheres or circles define locality. The closer it is to the circle's radius, the more cohesion and identity of the group Nation are obtained (Padison, 1983).

Likewise, studies on measuring ideologies within the US show that there are also different rationalities within the same nation (Berry et al., 2010). The researcher considers that there are

[16] The author, although having heard this quote attributed to Rousseau, has not been able to confirm the quote.

multiple rationalities; locality and ideology are elements that determine whether rationality is of one type or another, but they are not the only ones. In addition, the locality has changed a lot due to technology. It is no longer just geographical; there are many more common elements of individuals regardless of their grouping by geographic location, and there are more criteria than the location to engage the individuals.

The analysis interprets the concept of nationalism as an element of social empowerment -the territory belongs to everyone; it no longer belongs to one/ones- necessary but not sufficient for the transition from fiefdoms to States and thus generate a new form of cohesion, is more efficient and more effective than previous social technology, it was an emancipatory technology. But perhaps nowadays, the States have become obsolete and act as a brake for progress; we should brood over the concept of the State because it looks like complexity requires a positive interdependence approach, and States currently tend to have a negative interdependence approach.

8.6 Natural State and Social Organization

In this work, the analysis of the natural state begins to emerge when physiocracy is analyzed, associated with the naturalist movement, which infers those social processes, like in nature, follow a natural course (Hobbes, Locke, Rousseau, David Ricardo…). The researcher has observed thinkers such as Quesnay (Schachter, 1991), exponents of the new liberalism, who oppose the fact that rulers intervene arbitrarily in economic circulation. Elias quotes his words: "The rulers must know the laws that govern this circulation, but they must not try to regulate it through decrees without having any idea of it" (...) "automatic regulation, the free play of forces, would give rise to an order more improvements for consumers and producers than that created by traditional rules from above and the innumerable customs barriers between provinces and between States" (Elias, 1998).

It can also be appreciated that this argument has a bottom-up characteristic, differentiating the interests of those above and those below[17]. At that time, after the feudal experience, a small part of society realized that economic regulation should be in the hands of society and not in those of the ruler as it had always been. The reality of individualist capitalism through supposedly natural law -in practice without control- showed later that it was not the solution either; the capitalist concession makes more sense if a God watches and observes the action and regulates through access to heaven and hell. The moment God is removed from the equation, all the good that capitalism can be becomes pernicious; the "invisible" hand will no longer be "natural" but will be next to the one with the most, regardless of whether one has a conception that the human being is good by nature, the noble savage, as Rousseau maintained, or as if the man is a wolf for man as Hobbes argued.

[17] Quesnay was not an example of the bottom precisely, but he was below the hegemonic rule of power.

So that version of capitalism centered on a natural regulation, a regulation by God called the moral economy (Thompson, 1979a), was also not shown to be a correct regulatory solution that would allow the expected progress. Since it caused too much conflict due to inequality generated[18]. Nor should we forget that, regardless of whether those who control and accumulate the grain, as Thompson refers to, or the new industrialists and politicians, as Frey does (Frey, 2019) or the current bureaucrats, as Nieto does (Nieto, 1996), the result has always been similar: conflicts due to concentration of power.

The inability of individuals to regulate themselves and the need for a third party to regulate themselves can be seen in Thomas Hobbes' book De Cive (Hobbes, 1983). He rejects Aristotle's thesis, in which human beings naturally adapt to life in a polis and do not fully realize their nature until they exercise the role of citizen. Hobbes asserts that human beings are by nature unsuitable for political life since they naturally denigrate and compete with each other, are very easily influenced by the rhetoric of ambitious people and have a much higher opinion of themselves same as others.

Their passions magnify the value they place on their interests, especially their short-term interests. At the same time, most people pursuing their interests do not have the ability to prevail over competitors. Nor can they appeal to some natural common standard of behavior that everyone feels obliged to abide by. "There is no natural self-control, even when human beings are moderate in their appetites, for a ruthless and bloodthirsty few can make even the moderate feel compelled to take violent preemptive measures to avoid losing everything" (Hobbes, 1983). According to him, the natural state of humanity is war, and political order is only possible when humans abandon their natural condition of judging and pursuing what seems best to each one and delegate this judgment to another. This delegation becomes effective when everyone delegates: "I transfer my right to govern myself to X (the sovereign) if you do so too." And the transfer is done collectively only with the understanding that it makes one less of a target for attack or plunder than one would be in their natural state (Britannica, 2021).

8.7 The Relationship with the State, the Social Contracts.

This Enlightenment perspective introduced the concept of contractualism among individuals as a means of organizing themselves and understanding power relations, organization, and reality differently from their previous experiences. Until this point, relations were between subjects rather than citizens. This perspective posits that society is structured through a contract between

[18] Since God is becoming eliminated from the explanation of inequality, the reason for the social organization is broken, and the unequal situation of oneself concerning others is no longer admitted. It can also be seen in the section where Khmer society was referenced (Cooper, 2020) that social organization is based on an explanation of divine reality; everyone organizes and accepts inequality through that explanation. When divinity fails, everyone stops accepting inequality and adopts a social organization that responds better to the explanation of reality. In that sense, the Reformist contribution based on meritocracy to reach heaven was a big step forward in explaining reality, something unheard of in Europe up to that time.

all individuals that make up that society to create the State. The natural state is the previous state of the human being before society, the natural condition or the predetermined state from which it starts. Depending on the conception of the natural state from which one starts, there will be one type of contract or another[19]. If individuals start from a disadvantageous initial situation, they may sign a more unfavorable contract (Hobbes) than those who start from a better initial position (Rousseau). The latter is the only one to conceptualize an agreement to improve the initial situation and the natural state.

Contractarian Theory begins with the natural state, which includes freedom and equality as inherent qualities. However, Hobbes views this state as a terrible evil, as it allows individuals to freely engage in acts of killing, stealing, or appropriating everything (Hobbes, 1985). In this conception of the natural state, there is no justice or injustice, no moral obligation, and no ability to organize and cooperate on joint endeavors such as infrastructure, making progress impossible. In such a state, there is no security, becoming a "fight of all against all". Hobbes believes that despite being "a wolf to man," humans possess rationality, and nature tends to find balance (peace). This balance is achieved by creating pacts between individuals, which form a social contract defined by laws.

According to Hobbes, a pact between lawless individuals must be subject to coercion, force, and fear. Without these elements, the pact cannot be accepted. It is neither fair nor unfair, as there is no justice or injustice in a natural state. However, as more individuals adhere to the contract out of fear, the union of individuals who accept the pact increases. Individuals give up their natural rights to the King in exchange for security, survival, and peace. This reaffirms the absolutist power of the monarch, who maintains his natural right. Therefore, for Hobbes, absolute monarchy is the only way to organize society, as the natural state leads to disorganization or anarchy.

Another perspective on understanding the natural state is provided by Locke (Locke, 2003). According to him, the social organization on earth no longer depends solely on a divine entity, and the natural state is not as pernicious or destructive as Hobbes described it. Locke believes that the natural state is already a social state of the relationship between individuals. Although the state of nature is a state of freedom, it does not entail license. The absence of laws and authority does not mean everyone can apply their free will without consequences.

In contrast to Hobbes, Locke argues that individuals give up their natural rights in exchange for civil rights of freedom and property that become their responsibility. Establishes three natural and universal rights: the right to life, the right to liberty, and the property right. He also infers that if a right exists, it is because there is an obligation; if the obligation does not exist, the right becomes a privilege. Locke considers that individuals can organize as a society under these three rights, but since there is no form of control or regulation, he also establishes the right

[19] It is not the same to accept a contract when the signatory's situation is disadvantaged as accepting an agreement when the signatory's position is not disadvantaged; these are different contracts.

to judge and the right to punish. Further defines that individuals can withdraw from the pact if the monarch does not comply with the obligations of liberty and property.

Rousseau understands the natural state as an optimal freedom state that gives happiness (the noble savage); it is not an aggressive state. However, civilization or societies corrupt this natural state, affirming that nature has made man happy and good, but society depraves him and makes him miserable (Rousseau, 1987). For Rousseau, the meaning of a social pact is to organize individuals in the face of the complexity of the physical context since they cannot survive alone.

The starting situation of the natural state allows signing and establishing a pact with much more advantageous conditions. In other words, if an agreement is signed, it is to have better conditions than those already in place. This is why Rousseau states that it is not that everyone gives their natural rights to one person, but instead that everyone gives their natural rights to everyone, everyone organizes among themselves (the general will); individual rights or liberties are given, but in exchange social rights or freedoms are obtained. No one is above anyone, sovereignty is established among all; a democracy subject to the general will.

In such a way, according to the definition of the natural state, three different types of social contracts can be conceptualized that define relations with the State: absolutist type, parliamentary type, and democratic type. In the Social Contract Theory section of the Internet Encyclopedia of Philosophy, it is shown that, later, John Rawls, through Theories of Justice (Rawls, 1971), or Gauthier, through the argument that cooperation between selfish individuals is possible thanks to rationality, (Gauthier, 1986); both try to give other dimensions to the contractual relationship of the State.

Criticism of the Social Contract Theory is essential because it stresses that it is based on the conceptualization of a stereotype of an individual and that this individual does not exist. C. B. Macpherson distinguishes that Hobbes's individual is not the same as the current individual (Macpherson, 1973), and Carole Pateman also distinguishes a patriarchal stereotype in the different contract models (Pateman, 1988). It is the evidence that the individual in a natural state to which various theorists refer does not correspond to reality. It does not represent social diversity; it is governed solely by this stereotype.

8.7.1 Reflection

There are observable, objective natural laws with predictive capacity. Some physical laws are static and do not change over time, such as Newton's laws and thermodynamics. However, the natural laws referred to by these authors are dynamic and subject to change. The fact that, depending on how the natural state is defined, one type of contract or another is obtained indicates that natural law is not static but instead changes. Aristotle (Aristoteles, 1988) argues that natural law is not immutable in humans; natural "laws" change. Individual changes, society changes, and human natural laws also vary.

The forms of economic and political organization based on natural laws are ineffective in spheres of great complexity; if all similar individuals were equal, they could use those natural laws since they would all act in the same way under the same premises. The investigation does not find evidence of a single rationality, there is no single evidence of natural law, and although the Games Theory shows the effective and efficient logic of reasoning and acting for an individual, the information variables available to make decisions, the capacities of computing of his brain, his cognitive system, his environment, and social learning, makes his rationality not be the same as that reflected in a game scheme or as unique rationality states.

In the natural laws, reference is also made to rationality as a natural quality; the human being is rational; in the section that refers to nationalism, it is observed that rationalization is not the same; it also changes. At the same time, that rationality also generates irrationality. That a human attitude or thought has an explanation does not also mean that there is human rationality. Love is rational and irrational, although this irrationality has a rational basis (referring to Vázquez, 2016). Perhaps love can be very constructive and rational or destructive and irrational depending on how the individuals are, the definition of love they have, and the type of interdependence between them. We can explain "irrational actions" from a rational perspective, studying the causes and mechanics, but this does not mean that human beings have a unique rationality or that they have, in the end, the same rationality. Rationalities affect interdependencies.

The economic and political forms based on natural laws could be effective in complex contexts but not in more complex contexts; they would lose effectiveness. In such a way, the researcher also interprets that natural laws have a more significant explanation through power dynamics. But that, even at a high point of complexity, this dynamic is no longer equally effective, and the error will be more significant (see the complexity section).

The researcher assimilates that the social contract, expressed in the Constitution, defines the relationship between individuals and the State. But we must remember that this relationship with the State establishes the relationship between the individuals themselves, representing a form of intermediation. Individuals are organized through the State, based on natural law, with associated power dynamics, based on a stereotype of an unreal individual -or very different from the current one- and based on the complexity of the context very different from the current one, with a sphere of complexity much smaller than the current one (see the complexity section). The social contract and the State were conceptualized several centuries ago, and they had neither the current knowledge nor the current technological tools.

In this social contract, there is a conflict, power struggle, and tension between the securities and freedoms granted by each party. While securities are gained, liberties may be lost, just as protection can come at the expense of freedom. The researcher considers that this can be a negative feedback interdependence (Kelly, 2010). But on the other side, the more security the State grants, the more freedoms individuals obtain as a positive feedback interdependence.

8.8 Social Dynamics

In front of this distribution of monopolies between the State (public) and the markets (private), what position is society left in? What role does the individual play? It seems that the option is to create a monopoly and get a position of power. Schumpeter's analysis of capitalism is essential, as well as the industrialist as the industrious, the innovator. Schumpeter highlights the class structure of the capitalist system, exploitation, and inequality, where inequality of opportunities is unacceptable, but inequality due to effort is deserved; he concludes that the disparity of remunerations is beneficial for innovation due to the incentives it generates (McCraw, 2007). It is a correct argument only if this differentiating element regulates the disparity, but the disparity that leads to economic inequality is not reflected only by the level of effort resulting from merit.

Different from the conception of capitalism and its Calvinist side, where if there is money, it is because there is effort and merit. In other words, effort and merit explain part of the disparity in inequality and also of innovation, but other elements exert more force in explaining innovation, disparity, and inequality, such as the type of relationships, the kind of education, habits, the socioeconomic level of the parents, and a long etcetera that also marks inequality. Not only merit, effort, or the capacity for innovation are the definitive elements to explain inequality and its consequences (Stiglitz, 2012; Yu, 2018). This does not exclude that this element also affects the rise or social projection, but those are not the only ones. This appreciation is essential because there are, or have been, streams of thought that put the weight of the explanation on this element, on merit, together with the Solow growth model. Also it can be seen that Kuznets describes the economy as filling champagne glasses in a pyramidal cascade, from top to bottom, as the element of wealth distribution and social dynamics[20]. There is no gravity[21] in the economy; there is power. Finally, Piketty's studies, among others, show the opposite (Piketty, 2013). Moreover, Merton's explanation seems the most coherent since he affirms that some inequality is important for progress to generate incentives, but only a little.

One must also consider the history of transitions in the ways of relating and organizing from feudalism to modernity; Durkheim is considered who differentiates a shift from mechanical to organic solidarity (Durkheim, 1933), from less complex to more complex. Tönnies distinguishes between relations of community and association relations (Tönnies, 1957), as well as Elias, when he describes that transition and expresses those social ties had weakened considerably and many

[20] Is an example of the different schools of economic thought that have defined an economic hegemony of understanding relationships and ruling the world.
[21] As if the economy rules follows the law of gravity.

had broken. In the transition to modernity, relationships between individuals of different social classes that did not exist before are based. Social dynamic increases with ascending and descending processes, but the overall set is ascending (Elias, 1998).

The new technologies add new agents to the game, and it is no longer a game for two; it is a game of more, there is an increase in social dynamics, and there is more movement, ascension, and descent of powers. The printed books[22] of The Good Manners of Erasmus were handy in normalizing the court's customs to the rest of the population, both at the table and in the interaction between individuals, allowing those who ascended to socialize as equals within the court. And that was important; the court opened up much more, and many more individuals entered the institutions of power and the bureaucracy. They defined a new regulation. Postmodern and contemporary ways of relating are also considered, where Richard Sennett's study on the comparison and change of intergenerational values is essential (Sennett, 2000).

Throughout history, social dynamics have always been delimited in a configuration of control of monopolies, power, or the institutions to which individuals are linked. The technologies allow accessibility of social ascension, this ascension is the accessibility to the monopolies of power and the creation of new monopolies (new players).

Technological accessibility defines the framework in which social dynamics unfold and allows greater accessibility and greater creation of monopolies; this requires greater regulation to avoid falling into the disorder of inequality. The greater accessibility to monopolies requires greater regulation; greater regulation of monopolies tends to greater equality, and less regulation of monopolies tends to greater inequality. This arises with order and disorder in the complexity section, in such a way that regulation is order, non-regulation is disorder, while equality is order and inequality is disorder. This inference is reminiscent of Frey's sustained: "societies with great disparity between rich and poor are prone to oligarchies and populist revolutions[23]" (Frey, 2019).

8.9 Contentious Politics

At this point of the investigation, the analysis considers the interaction between society and its technological-social creation to better organize itself, the State.

Both Weber (Weber, 1946), Elias (Elias, 1998), Rawls (Rawls, 1993), and Tilly (Tilly, 1990) indicate that the creation of the State required capital and coercion. Morris points out that no coercion was required[24] (Morris, 2012). Morris highlights to something that the research considers important as well: that the State is not coercive, but rather the claims to power of those who control the State are. And he quotes Anscombe: "civil society is the bearer of coercive rights

[22] Printed books at that time were a new technology, access to books after the printing press should be like having the internet today. An example of technological accessibility, but very limited at the same time, few knew how to read.
[23] The exception would be an organization like Hinduism, where the caste system assumes this differentiation since the balance of the disparity is found in other lives, in reincarnation.
[24] In the researcher's opinion, the explanation of coercion has more weight when it is done from a perspective of power, different from the perspective followed by Morris.

that may not exist among men without government" (Anscombe, 1981). Suggesting that society established coercion at the time the State is constituted, it is interpreted that civil society interacts with the State through coercion. Coercion is an element that has been present in the historicist research bibliography, it is not illogical that it is the traditional form of interaction between power structures. Power through coercion can be appreciated in Machiavelli's The Prince (Machiavello, 1975) and in Robert Greene's *The 48 Laws of Power* (Greene & Elffers, 2000).

At this moment, the researcher infers that coercion is part of a transformation and feedback process; the researcher considers that coercion is an interdependence that generates a negative feedback relationship. And observes that the relationship between political agents is consensus by struggling, it generates a violent discourse, and it must always have to fight to achieve something. Many ideologies base his speech on the creation and agglutination of struggle. The struggle between egotistical -individualistic- positions is the "natural" way to reach consensus and through which politics develops.

Contentious politics means "episodic, public, and collective interaction between claimants and their targets when (a) at least one government is a claimant, a target of claims, or a party to the claims, and (b) the claims, if would be made, would affect the interests of at least one of the claimants" (McAdam et al., 2001). Tilly defines contentious politics as "interactions in which actors make claims related to the interest of another person, in which governments appear as targets, claim initiators or third parties" (Ibid.).

The same research differentiates the concept between contained and transgressive, the first more formal and the second more informal. There are four fields of analysis or perspectives to analyze contentious politics: 1) structural analysis, 2) rational analysis, 3) phenomenological approach, and 4) cultural approach. In this differentiation process. It is also essential to detect three elements: a) the mobilization, what causes the mobilization, and what causes the mobilization to stop, b) the actors and c) the trajectories or transformations. This research team defines the mechanisms of contentious politics as a delimited class of events that alter the relationships between specific sets of elements[25] in identical or very similar ways in various situations. And they differentiate between environmental (a), cognitive (b), and relational mechanisms. They also define processes as regular sequences of mechanisms that produce similar (usually more complex and contingent) transformations of those elements. They distinguish between processes of 1) mobilization, 2) political identity formation, and 3) protest. Defining the episodes as continuous streams of disputes that include collective claims arising from the interests of other parties.

Finally, the analysis involves: 1) Identifying contentious episodes or families of contentious episodes that will have some problematic features. 2) Locate the processes within them that constitute or produce the problematic characteristic. 3) Search for the crucial causal mechanisms within those processes (Ibid.).

[25] The researcher understands that such elements are groups or institutions.

Based on the bibliography referred to in this part of the analysis that describes the State and the transition to the State -including Weber's work on the creation of bureaucracy- the researcher understands that, in all European warrior societies, the sword has been a habitual and unavoidable means of achieving means of production. The threat of the exercise of violence has also been an essential means of production. "Only when the division of functions is very advanced, when a specialized monopoly administration has been produced as a result of prolonged struggles that manages the political functions in how much social property, when there is only a monopoly of centralized violence and exercised publicly in great extensions, then, competitive struggles for the means of consumption and production to the exclusion of physical violence can take place, and only then is there the type of economy that we are used to calling "economy" in the strict sense, and the type of struggle of competition that we usually call "competition" in the strict sense" (Elias, 1998). The State "monopolizes the sword" and allows a different economic and productive relationship based on capital (corporatism). Coercion is still the dynamic, but not with a sword. The language between the State and Civil Society sounds coercive, and if the language is coercive, the individuals perhaps may have a behavior tendency to be coercive like the Sapir-Whorf hypothesis[26] (Kay & Kempton, 1984; Lucy, 2015).

8.10 Human-technology relationship. The homo-machine

Middle-class jobs and mass production are forms enabled by machinery, and technology causes the dislocation of workers (Frey, 2019). This is mainly meant by:

- The emergence of new technologies makes jobs and skills superfluous and probably outdated.
- Enabled technologies make people more productive on existing tasks or create new jobs. The analysis is sensitive to Luddism; in hindsight, the machines have gotten more work than they have eliminated.

During the mechanization era, there was resistance to technological progress. This resistance was more successful in France than in Britain, which is one of the reasons why the industrial revolution occurred earlier in Britain. In French cities, products made in factories were banned from most markets (Ibid.). Hostility and social destruction have historically followed when technological progress replaces work. However, when progress empowers individuals, favors them in competition, and the gains from growth are more widely shared, new technologies are more likely to be accepted (Ibid.). The term "Engels' pause" is an ambiguous term and should be discussed in more depth..

[26] The Sapir-Whorf Hypothesis is a linguistic theory that suggests that the structure of a language influences the way its speakers perceive and think about the world around them. According to this hypothesis, language shapes our thoughts, beliefs, and behaviors (Notion AI).

Social inertia should also be considered; However, Christensen does not name it directly in his analysis of the impact of technology in the corporate world (Christensen, 2016). If there is a change, then there is resistance to this change. "Social inertia can also be seen in things like people's attitudes towards new technology, where people may be resistant to change even if the new technology is better" (OpenAI, 2022). Social inertia refers to the resistance to change, regardless of whether the change trend is positive or negative. It can be observed as a trend of transitioning from few changes to many changes within a unit of time -future shock (Toffler, 1970)-, or from many changes to few changes within a unit of time.

The way of transition shows that:

- Although technology has a democratizing, emancipating, and structuring component of progress, human interests, and power dynamics interfere with these components. In such a way that a liberalizing ideology becomes a repressive and punishing ideology because new technologies create new forms of power and inherently new interests since, as we have seen, democratization makes power more accessible. Capital is democratized and becomes more accessible with the force of Protestantism (Weber, 1955), constituting an additional legitimacy for the current capitalist system. Even if technologies democratize and create new tools, the power dynamics interfere to control the technology.
- It must be borne in mind that Calvinism promulgates that if the job has been done well, there is a good reward, understanding that: "If you have done it well, it is because you have been rewarded (prove of money)". But also because, for the first time, the capital was accessible to the rest of the individuals; until then, capital had only been accessible to the elite, "money is expensive" dictates a medieval proverb. Elias' explanation complements this argument: "It is not possible to isolate the specific factors, but without the differentiation within society, without the privatization of the land, without an intense increase in the population, without the constitution of urban communes of autonomous merchants and artisans, the need for money in society would not have sought so quickly, and the economic-monetary relations could not have grown so quickly. It is impossible to understand money's decrease or increase in its use. But it can only be understood from the point of view of human beings and the structure of human relationships. The primary forces of this transformation must be sought in the modifications of human integration; there is no doubt that once the use of money began to increase, it gave rise to all this movement, to the increase in population, to differentiation, to the growth of cities, up to the point of saturation" (Elias, 1998). Capital is a social technology subject to power dynamics, and technologies change according to the context (some authors could say evolution); exchange, markets, or money may not be the final technological

tools to improve economic interdependence. In that case, this new social technology should present more efficiency and empowerment than markets or capital.

- It is also essential to see the transition of the use of capital that shows that the natural economy of exchanging goods for money, in many moments of history, both are accepted and used (Van Werveke, 1932). It must be added that capital allows a broader execution of production processes, the elaboration of more complex products, where different actors and ingredients are involved, is viable with capital, not with exchanges. In such a way, capital improves interdependency.
- Self-regulated capitalism makes more sense if God regulates human action; without a divine element, the rule establishes the new figure of the State as a regulatory natural law entity. Although it is not the best regulatory element, no known alternative exists.
- In technological transitions, the creation of new powers has been bloody because of the interests that behave and the perspective that social inertia grants.
- Technological changes have generated inequality, as seen in Bartels: "Economists associate the increase in inequality in the last 30 years with major structural changes in the US economy, including demographic changes, globalization, and technological change" (Bartels, 2016). A technological change in which there is a pause from Engels (Frey, 2019), a period of adaptation. And yes, technological changes indeed generate inequality because whoever dominates the technological tools establishes the hegemony of power in their favor.

As previously mentioned, technologies follow a pattern of innovation upon innovation. In The Economics of Industrial Innovation, Freeman and Soete dedicate a chapter to explain how the development of an internal combustion engine favors the creation of automobiles, and these, the development of tires and asphalt roads, and these the motels, fast-food restaurants, and weddings in Las Vegas (Freeman & Soete, 1997). There are multiple possible trajectories, influenced not only by stochastics but also by forms of interrelation, with interdependencies and feedback that ultimately lead to some courses that can be studied from a causal prism. The steampunk paradigm represents a dystopian vision of a society based on steam, without the use of oil, and from a Victorian trajectory set in the present day. In that other "reality," the causal sequence would have been different, but there would also be a causal sequence with other interdependencies and feedback. Imagining a dystopian society might resemble our trajectory in that alternate world. These trajectories from which we come are our heritage, and we cannot change it, but we can change our future courses; technology is an "ally" that grants new levels of empowerment since the technological axiom will be in all trajectories both in ours as in a supposed steampunk. It gives tools so that individuals can control the context and develop better. But it is impossible to propose a solution, or a final state, starting from a different beginning point trajectory far from the one that has been followed, but to define a starting point from the current trajectory.

Human relations with technology become more complex because of the summation of innovations. We live in a more complex both substantive and instrumental technology perspectives. And people need to know, control, create, and understand technologies.

8.11 The Marxist Lace

The "civilizing" process of reform is a process of culturalization that has its sights set on those at the top; those at the top are seen as a reference in the ways of speaking, acting and thinking. Although it is a sample of a hierarchical and centralized top-down conception, it generates greater interdependence[27] since it tells people they can be "court" too. Although the court and the bureaucracy follow a centralized and hierarchical structure, when reference is made to its opening up, reference is made to its greater accessibility and decentralization.

The original accumulation, the enclosures, and the expropriations are examples of the effects of the transformations that give way to modernity, while on the one hand, monetary circulation increased; on the other, commercial activity developed, and the income of the classes increased. The bourgeoisie and central power (cities) increased, and those of the remaining nobility (based on wars) decreased. Changes in war techniques allowed groups of commoners to kill the knights, something unheard of until then. Some of the knights were condemned to a life of misery; others dedicated themselves to obtaining, by robbery and violence, what they no longer obtained by peaceful means, while others were able to stabilize by gradually selling off their assets (Nicholas, 1968).

It changes the form of social organization, although it is presented at the beginning as one of the steps of emancipation and liberation of the individual from feudalism; in practice, as Marx, Engels, and Thompson show, it was an unbalanced and arbitrary process. It gave more power to individuals who mastered and used new technologies (ascension) than those who already controlled existing technologies (descent) (Frey, 2019). Creating a new paradigm, a social technology that responds to the further complexity of reality, and new social organizations according to the new paradigm created. Although the kings issued laws that protected the peasantry, thus trying to maintain their power, the conjunction of three events, 1) the Reformation, 2) the Glorious Revolution, and 3) the ascension of William III of Orange as monarch, consolidated the change of power to a minority of "makers of surplus value and holders of land and capital" (Marx, 1979) starting then, "The Great Usurpation," a series of appropriations fraudulently and violently, defined a reconversion of the land through the enclosures, thus legitimizing the land as a commercial item.

[27] New interdependencies.

Said process, -together with the Agricultural Revolution-, monopolizes the countryside for the new type of capitalist agriculture; machines quickly enter, and the entire peasant population is "expelled" to the cities, generating an urban surplus of the free proletariat (mostly they can trade with their children). The market and the cities cannot absorb so many people, so these, adding the great difficulty of adaptation -that of the manufacturing industry- are forced to live badly without any occupation. If an element must represent a group of individuals to generate a balance, this element would be a State like the one we understand today (in King's time, those who spoke about the State were considered terrorists).

Marx (Marx, 1979) and Polanyi (Polanyi, 1989), Macpherson (Macpherson, 2010) or (Garrod, 2016) point out that the new economic power uses the power of the State to eliminate feudal property relations, separate the peasantry of its common areas, and introduce capitalist rationality. The industrialists, hand in hand with liberalism, use the concept of a State to serve their benefits; there is no one to stop them because they dominate the technological tools, and the new economic and political technologies.

Gramsci recognizes the role of the State as a complex political entity, not simply as a tool of the bourgeoisie for its objectives (Lears, 1985). Frey corroborates this perspective since the new political power was the one that dominated the latest technologies; it was the one that gained from mechanization. And previous forms of social organization representing church-kings could not handle such complexity. This analysis comprehends this as evidence of technological obsolescence of the form of social organization, obsolete social technology. The previous forms of social organization did not respond to the new reality of the contexts created by the new physical technologies; it was a dissonance between social and physical technologies.

This new power formed by industrial laws generates to enslave the proletariat that lives without any occupation. Marx describes in The Capital a grotesque legislation by force of shackles, irons, punishments, and death to strip the human being of any link with life that is not productive. Thanks to the "natural laws of production," man becomes a mercantile element and subject to the system itself (Marx, 1979).

The geopolitical context in which all this activity takes place is the colonial system, imperialism, and the concretion of the new forms of State that help promote and feed said system through formulas such as the bond system and public debt, the new tax system, or the protectionist system. And through which the moments of "original accumulation" can be reproduced in other parts of the world. Thus, the new system takes over all the territories and their people by force, revealing great injustice and social change moments. The process of concentration of capital is getting larger and more ferocious, requiring continuous expropriation, and as the model advances, the process becomes "expropriation of the expropriator"; or "expropriation of many capitalists by few capitalists" (Ibid.).

8.12 Reflection

The research shows that the power dynamic based on controlling monopolies is repeated, and technologies create monopolies. The relationship with the State follows a coercive power dynamic; Civil Society and Corporatism normalize this dynamic, it is the language of pretension, and power continues to be achieved through struggle. This significantly limits the type of interconnections and the interdependence of relationships; it is a limiter of the possibilities of progress.

The fact that rationality is different implies that the agents will have different information because of their geographical scope, the information they receive, their social surroundings, and how they interpret that information. Power interests shape rationalities and use ideologies by means of nationalism for their cause (influence).

Although the machines provide more work than they eliminate, there is an Engels pause and social inertia to change; they do not justify many of the actions, decisions, and paths of the then-new influential people. The relationship between society and technology is recursive, but the link with social change is defined by the creation and democratization of power tools and by power interests.

9 Magic and Governance

An important element when analyzing the technological and social transition must be included when examining the human trajectory and its relationship with the contexts to understand the forms of organization. As previously stated, the work observes that the changes in the contexts produced by physical and social technologies modify and create new material and social contexts. They promote new forms of social organization according to a recursive dynamic. Physical and social tools carry out the recursive process between technology's physical and social dimensions. In this section, magic is explored as the tool that sustains the first version of a system of social organization. The magical element is a characteristic element of the human being; magic has structured the forms of social organization. Magic fits the previous definition of social technology, a technology that embraces greater complexity and is responsive to its surroundings and context. A basis to develop new technologies, technology over technology. The forms of social organization articulated through the magical element have marked most of the trajectory of human organization. Only in the last few centuries have the democratization of knowledge and the emergence of positivism defined a different social organizational technology.

9.1 Approach and Method

The analysis considers the knowledge about religions from the study by Émile Durkheim in *The Elementary Forms of Religious Life*, which shows religions as representations of the social collective, elements of solidarity and cohesion that create a group identity, and give an explanation to the reality (Durkheim, 1995). The development made by Tönnies (Tönnies, 1957) on the transition from mechanical to organic solidarity is also considered in the sense of the action of social transformation, or the way of understanding reality and organizing based on this new interpretation.

This theoretical base is also contextualized with the holistic perspective, following the methodology of complex thought, from the vision that the human being has of his environment to organizing himself, not only as an individual but as part of a whole. The whole is more than an individual can appreciate seeing. Vision also includes perception with the postulate defined by Tolman and Brunswik: "perception is organized in terms of making sense of a pre-structured causal world" (Tolman & Brunswik, 1935) in such a way that if the pre-structuring changes, the perception changes. This aspect is also related to the concept of frame developed by Goffman (Goffman, 1974), Lakoff (Lakoff, 2002), and Yochai Benkler (Benkler, 2011). And also, with the entry of science into the life of society, which has also been mentioned in the section on research design and methodology through scientific convergence (Watson, 2017), magic and science share some human aspects, such as science helping explain magic, or magic by science explaining reality. The magical concept's dynamics also fit with the work of Huizinga and the Theory of Homo Ludens (Huizinga, 1938).

9.2 Development

The work approach is that to understand the form of social organization, one must understand the vision of humanity's physical ecosystem, its surroundings, and its relationship with ecosystems. In prehistoric societies, the authoritarian system was "nature" (Turnbull, 2010). And the link to understanding nature was the magical vision of what the individual interpreted about his surroundings since this explained the physical context. From this point of view, the magical element establishes the reason for the ecosystem, and its relationships with it, defining the ways of organizing.

Initially, this analysis focuses on the magical essence of the Middle Ages; it can be perfectly appreciated in Huizinga's book The Autumn of the Middle Ages that the rules are magic, the rational is unreliable, and superstition dictates life (Huizinga, 1965). The context has been magical and static throughout feudalism, with very static and delimited social networks and a very limited action radius. The reform defines new limits and greater dynamism; there is an aspiration for salvation. On the contrary, in the Council of Trent, it continues to be demonstrated that the human being is a sinner by nature, by original sin, and by killing Christ. From this perspective of reality, an aspiration towards something higher makes no sense, nor does a meritocratic vision. Also, in this, The Reform allows social empowerment. It affects the ways of organizing ourselves, but the organization is the consequence. The cause is the new interpretation of the context in how reality is understood, explained, and shared. It can be called a shared social construction or a main frame (Lakoff, 2002; Benkler, 2011). The new physical technologies or artifacts break the schemes and metrics that explain reality. New social technologies allow a further explanation of reality, with greater control of the contexts. As a consequence, new forms of organization are created.

This analysis explores the relationship between the physical and social dimensions of technology. The former involves controlling and understanding contexts to create, modify, or adapt physical reality. The latter explains and gives meaning to that reality; by explaining reality, social technologies (organizations) can help create a "better" reality or "correct[28]" the dissonance. Physical technologies (artifacts) create new realities, and social technologies explain them by organizing according to them. However, when social technologies cannot respond to a new context or a new reality driven by physical technology, dissonance occurs, and innovation emerges. Society is organized to respond to a reality but not to something it does not perceive as real.

9.3 The Magic Forms of Organization

Starting from a hunter-gatherer context, it is assumed that individuals taste what they find to experience, learn about, and control (knowledge) the ecosystem. Psychotropic fungi and plants are elements found in ecosystems, now and thousands of years ago, and may have relevance in opening the door to the world of "what is not seen" from a "normal" state. Based on the relationships between physical and social technologies, the analysis speculated that if magic is a social technology, using the various plants to communicate with the first Gods or understand reality would be the physical tools (Müller & Schumann, 2011). In that case, social technology would be based on these tools, showing new ways of understanding and organizing themselves in that context. "A broad range of ethnographic and archaeological writing (e.g., in Goodman et al., 1995) have evidenced that drugs are integral components of culture; fundamental to religion and social life and the formation of cultural identities, civilizations, and the world economy" (Wadley, 2016). Wadley also defines how drugs have hierarchized societies; Maca has studied this type of relationship in Mayan society (Maca, 2015), and Ruck has analyzed the influence of psychoactive substances on human cultural and organizational evolution (Ruck, 2016). More recent analyses exist on the relationship between psychedelic substances and transcendental or religious experiences (Pedersen, 2020).

Regardless of whether there is a relationship between these substances (tools) and the development of a magical context to explain reality (Guerra-Doce, 2023), it is observed in these contexts that the chief shaman figures are closely linked, chiefly related to physical force and

[28] Compensatory function in (Rosenthal & Siegel, 1959).

shaman related to magic force. In some organizations, one has more weight, in others, the other has more weight, in others, they are the same, or they go hand in hand; or in others, they even compete. And although in anthropology, there are always exceptions; it can be said that the magical component is in all of them. Having a boss, who is a friend or relative of the Gods, establishes an advantage for the whole group to control uncertainty, explain the context, and give the courage to defeat an enemy (Menéndez, 2003; Díaz, 2010). This explains natural reality; society is organized based on this explanation, and thought is standardized (culturalization). In addition, the magical element also gives a different connotation to war (war with magic is not the same as war without magic, magic presents a wide range of incentives); deep down, it is still another way of living reality, a different frame.

In the magical world, there is no distinction between reality and non-reality, everything can be reality; in a context where the valid explanation is magical, the reality is beyond what is seen. The magical explanation complements what is seen and felt. Based on the descriptive writings of Malinowsky's diary, Mead's work on non-Western cultures, or Marvin Harris's work on religions, as well as the entire historical set implicit in the dissertation, it seems that humanity has given greater importance to the non-observable to explain the context, than to the observable. Magic corrects the dissonance between actual and expected (Rosenthal & Siegel, 1959), and explains reality (Gaskill, 2008). And it seems that magic is the element that explains complexity, like a shortcut or a catchall, a social technology.

9.4 Magic and Complexity

The second *Book of Economics*, initially attributed to Aristotle, it is quoted: "Dionysius of Syracuse, wanting to raise money, called an assembly and said that the goddess Demeter had appeared to him and had ordered him to bring the women's ornaments to her temple: he, in fact, had already done it with the adornments of the women of his house, and he asked that the others do it too so that the wrath of the goddess would not fall on them. And he said that whoever did not do this would be guilty of plunder from the temple. They all took what they had for fear of the goddess and the tyrant. After offering sacrifices to the goddess, he took her ornaments, saying that they were lent to him by the goddess. After some time, as the women wore ornaments again, he ordered that whoever wanted to bring gold should offer a certain amount to the temple" (Pseudo-Aristotle, 1984).

To organize more complex contexts, decisions cannot be made through altered states of consciousness, irrational premises, or information that does not represent reality. When the physical and social context becomes more complex, the human being's ability to handle data becomes limited. The relationship with a limited ecosystem and a small sphere of complexity allows decision-making from a single prism, a magical perspective. At the moment complexity is added to the context, or that sphere enlarges, the vision from that only magical prism is no longer enough for the control of the ecosystem, in the sense that, if there is no correct information, there is a greater chance of making mistakes and do not solve the problem.

The explanation from the perspective of complexity would point out that society began to stop taking collective decisions from a solely magical vision with the gradual entry of humanism and positivism because these better explain the context according to the complexity society acquires. Explaining reality better allows society to organize itself better. Being a recursive process that opens a new vision to understand the physical and social context scientifically; and allows humanity to cover greater complexity, and decision-making becomes more and more rational and individualistic. As seen before, if the explanation of reality changes, then the forms of organization change according to that reality (recursive relationship between social and physical technologies).

This relationship means that if the magical explanation does not adjust to the physical context, does not provide an answer, nor solves the problems of complexity, another would be sought to give a new explanation. The positivist explanation further responds to the physical and social context and allows solving complex problems encompassing more significant complexity. From this moment on, it is understood that collective decision-making is carried out from a more rational and less magical perspective, and the social organization is rationalized (Elwel, 2013).

This explanation does not exclude the explanation of power, nor that the organizational form generates irrationality, as stated by the work of Weber and some institutionalists, or the explanation of the configuration of nationalisms. Nonetheless, the transition to science has provided a more significant component of complexity control, just as magic did at the time; it transcends complexity, and it responds to complexity through the form of organization.

9.5 Magic and Technology

The magical element has marked the forms of the human organization according to the interpretation of what surrounds them. Magic has a natural attraction in the human being, the human surrenders to magic, giving it legitim power, and there is a certain tendency to explain the inexplicable through magic. As has been said, the magical element explains what is not seen.

The first reflection involves remembering the Frankfurt School, specifically Adorno and Horkheimer when they described the irruption of the radio in society and how people went from establishing the nexus of debate in the central square with the town crier to a space in the home, private, and with few people, and, where the discussion is not so rich and complete (Horkheimer et al., 2002). The radio had a substantial legitimizing role[29], which came from the technological component of the tool (it can be seen in Orson Welles in the War of the Worlds and what Baudrillard later described as hyperreality). Radio explains what is not seen, television explains what is not seen, YouTube explains what is not seen, just like the church did, and just like a video game explains a reality that is not seen, with a different appeal. That attractiveness is given a

[29] Propaganda Minister Joseph Goebbels created the Volksempfänger, the people's radio, a very cheap radio model given to all German citizens.

value of legitimacy. Magic explains what is not seen, and technology has this magical component; Arthur C. Clarke's third law is famous: "Any sufficiently advanced technology is indistinguishable from magic." (Clarke, 1973).

Technology explains what the human being does not see but exists, which makes sense and coincides with the description of magic made at the beginning of this section. Time ago, Shazam App was magical, just like the telephone, the radio, electricity, or agriculture, these are elements that reflect a complexity that is beyond human comprehension; these make them realize the complexity, a dimension that individuals do not understand, much bigger than them but they have to his reach and control. That is the magic feature.

Magic is necessary to understand life and to give meaning to life because it corrects the dissonance that exists between the ideal form of organization and the real form of organization, for understanding the mismatch between the perfect world (the ideal) and the real (non-ideal). The researcher considers magic not only to understand the context for decision-making and social organization throughout the history of humanity. But also, to understand the current individual and social perception schemes, in the similarities found with the contemporary "rational" forms, the magic does not disappear. Science does not eliminate magic, it will define the new limits of magic, but magic will always be present in the human being to express what cannot be understood, to fix the cognitive dissonance between the real and the ideal. The same cognitive dissonance that moves to innovate. At this point, it is also necessary to define the process by which social technology is developed, its basis, the support on which an explanation will be given to reality, and the reason for social technology. The researcher relates two theoretical bases, the first referee to conceptions of life or "frames" and that we can find an answer through Framing Theory (Lakoff 2002; Goffman 1974). And the other refers to the Homo Ludens Theory (Huizinga 1938). In this latter one, magic has a more localized role and proposes a solid relationship to give part of the explanation of human activity.

The argument starts from a hierarchy of structures: 1) demographic structure, 2) economic structure, 3) political structure, 4) cultural structure, where the latter is the structure that reproduces and mutates the rest of the structures (Sabaté, 2019), leaving the capacity for the agency outside of these structures, but also involved in them since individuals are the fundamental element in how the structures develop. Magic is cultural structure, and Huizinga affirms that human culture sprouts and develops through play and not only as a physiological or biological aspect of childhood, like "the discharge of energy, the measurement of force, or the preparation/learning for life", functionalist perspective, but in the mechanism to explain the function.

If one starts from the premise that the context delimitates the characteristics of the culture, and culture defines the boundaries (explanation) of the context, the game is the mechanics through which culture develops. Summarizing the Homo Ludens Theory:

- The characteristic that defines the game is its dual character: winner/loser, serious/cheat, or ability/luck, among others.
- The dynamic of a game is made up of a triple union of three essential elements that create a hermeneutic form: game, fete, and sacred action. The relationship between these three elements defines the structure of that culture:
    - Relationship between game and sacred action, for the conception of worship as myth, drama, or magic.
    - The relationship between the game and the fete (party) is vital to renew the cycle, generating cohesion, and giving coherence to the game.
    - Relationships between sacred action and party, luck, and fortune are rooted in the sphere of the sacred of any human conception and have a natural attraction in people. (e.g.) People can explain inequality by means of fortune, the luck of where they have been born.
- Competitiveness or agon can be understood as the carrier of the game; it is the element always present and is the key to group cohesion. The pride of individuals (players) in front of others becomes an intrinsic stimulus of the game since the winner's success is transmitted to the rest of the group (as when a soccer player scores and the feeling of the individuals who see the match on television is that they scored). The viewers do not play, but they win.

Homo Ludens
Core System

- **Relationship between game and fete**: when players win, or overcomes the game, same relationship as working life and leisure life, or routine vs. non-routine.
- **Relationship between fete and sacral sphere**: myths, temporality, drama; and the perception of the surrounding when feeling in fete.
- **Relationship between game and sacred action**: luck or magic, a necessary element to legitimate the game.
- **Agon or competition** as the motor, that runs the dynamic of the game, and generates values as cohesion.

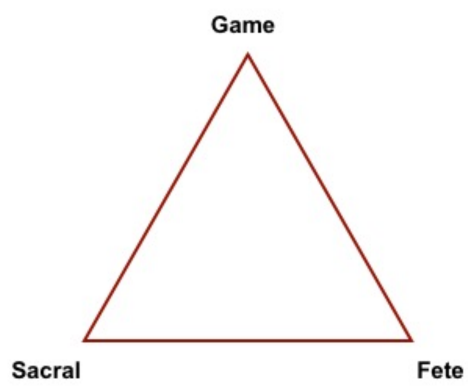

Figure 6. Huizinga scheme of game.

The Gift (Mauss, 1925) can serve as an example to understand societies' cultural and value structure in a different way from Homo Ludens Theory. According to this perspective, culture can be seen as the set of different games that organize different societies: honor-oriented in Potlatch, which focuses on the prestige of the group and does not involve hoarding of goods, and contemporary Western, which emphasizes the individual status and the accumulation of goods (economy). Both games involve competition, with agon being the driving force behind both. In honor-oriented Potlatch, agon is projected onto the community, while in Western, it is focused on the individual; both have the struggles and the parties to reinitiate the game. This duality is expressed in such a way that the real game requires another well-differentiated imaginary game to give meaning to it. Likewise, the imaginary game also needs an actual game to make sense. Neither can exist without the other[30]. Game structures are individual and social, with relationships between them, which could be considered part of a "natural" law.

This perspective allows us to understand the individual as well as the set of his games. Each individual is made up of multiple game sets, and understanding the set of games, and the relationships between them, and the differences between them should help us better to understand human beings and the relations between them, make a direct relationship between individual and social, there's no micro-macro or macro-micro perspective since there are sets games, social or individual, physical or magical. As already said, magic will always exist; it is a basic element on which social technology is developed to explain reality, and games explain reality. Games are physical and magical, individual and shared, the challenge the research raises is how it would be possible to measure and classify what is fete, what is sacral, or what is game.

10 Analysis of Organizational Strategies in Front of Complexity. What to Measure

There are multiple ways to analyze individuals and society in order to understand the mechanisms behind people's desires, beliefs, thoughts, intentions, and actions. While economists tend to look for a single mechanism, such as rational choice theory, that can apply to both individuals and groups, it may be more useful to consider multiple explanations. Desires, beliefs, thoughts, intentions, and actions can take on multiple configurations and can be diverse, which is an important aspect of understanding games and the relationships between them.

The analysis of human action and the strategy according to complexity seeks to understand the elements that affect the mechanisms of human interaction, both individual and social. For this part of the research, the analysis of cooperation and competitiveness that the researcher carried out in the Sociology Final Degree Project has been initially taken, which specifies the frameworks, contexts, and individual and collective action. To establish later the analysis of the dynamics of social interaction in the master's dissertation (Huerva, 2018), with which they complement one more part of the explanation.

The texts and diagrams of the Social Innovation and Transformation MSc dissertation have been added, so it is self-cited, although the texts are improved and specified. Adding more "layers" of information to help to understand and interpret the human organization trajectory to

[30] The relationship between games seems to have similarities with the recursive principle.

understand how to capture the data. As well as the possibilities of social analysis offered by social networks (Mosleh et al., 2022). The ability to predict social data is a reality; simply with Facebook likes underlying behaviors can be forecasted (Bachrach et al., 2012; Kosinski et al., 2013; Nave et al., 2018; Gjurković et al., 2022). Or in a more specific contextual environment predicting grades and dropout (Rovira et al., 2017). This research aims to explore various methods for predicting actions in a particular context, considering different factors. In order to achieve this, it is important to identify the indicators of social behavior that can be used to measure and predict actions.

10.1 Context and Action

Initially, to analyze how individuals organize themselves in contextual situations, the analysis is based on Fiske's studies on the forms of socialization; the author distinguishes between a) communal, b) vertical, c) para-equality, and d) market (Fiske, 1992), the mix of this forms defines societies. Also, it can be seen that the axiomatics that dominated the second half of the XX century, in terms of social dynamics explanation, is the theory of rational choice, developed in the Anglo-Saxon world and observed in the work of Olson (1965)[31].

But currently, Yochay Benkler (Benkler, 2011) affirms that following the preconception that human beings move for their own interests and assuming actions in accordance with rationality, these become forms of social control, which reward or punish in a market of incentives that condition the individual (affect the feedback) (Huerva, 2017). The economic structure -and, therefore, the cultural structure that reproduces the economic structure (Sabate, 2019)- directly rewards the individual through the community that accepts and legitimizes these incentives. Benkler uses the Framing Theory; if this setting, or environment changes, the rationale of the incentives also changes (Benkler, 2011). Fits with what is described in the nationalism or magic sections.

According to this explanation, it can be seen how incentives change when leaving the old regime, the frequency of technology increases, and the forms of survive too. The irruption of capitalism changes the order of incentives, positioning one, especially as the main one -money- and associated with individual interest. And assuming that if an individual has economic freedom, he is freer to depend on others for his survival, so that, with money, the control of his ecosystem can be better, and his survival more assured. A social system (technology) based on money (technology) has been conceptualized, it is optimized for money, and money is also a social signal, so it is inferred that getting rich is a reward, or getting poorer is a punishment –or having done things wrong- from a more Calvinist view (relationship between game and sacral).

[31] Laville also points out that the current economic model places scarcity at the center of the analysis, based on individual choices in materialistic interests. It contains an "economist sophistry" that consists of the confusing economy and market mechanisms (Glémain & Bioteau, 2015).

Benkler uses the example of the ten-coin, ten-player experiment: the first player is given all ten coins, decides how many to keep, passes the rest to the next player, and so on. In this case, the "rational" strategy is for the first to hold a coin and so on with the rest until everyone has one. Everyone wins through an action that carries an element of trust, which, depending on the level of trust between the participants, everyone has a coin (or not). In the same exploration analysis, the experiments based on the Game Theory give more light to the explanation, especially the experiment called Community Game and Wall Street Game (Fig. 7) (Liberman et al., 2004; Huerva, 2017).

Community Game / Wall Street Game

Action 1	Action 2	Reward
A cooperates	B no cooperates	B=10 ; A=0
A no cooperates	B cooperates	B=0 ; A=10
A no cooperates	B no cooperates	B=2 ; A=2
A cooperates	B cooperates	B=5 ; A=5

Community game: 70% are cooperating, and follow the game with same strategy.
Wall Street game: 30% starts the game cooperating, decreases along the game.

Figure 7. Scheme of the experiment result led by Liberman and his team. Depending on the game's name, the action and the outcome change.

The results differ due to how the game is named and the framing or interpretation scheme with which it is built, and it will define its behavior depending on how the game is called. The trust between the members of the group and the assertiveness that comes from knowing that the other member of the group will act in the same way makes the benefit maximum and reciprocal. Cooperative games follow a much greater dynamic of progress due to the fairness that it behaves and the low level of risk it bears. On the contrary, acting non-communally decreases equity and increases risk. Studies focusing on behaviors show that collaborative cultures are more successful and survive better in contexts with challenges and changes (Richerson, 2005; Boyd, 2007). In addition, it is crucial to understand the distinction between the types of justice (fair) that define Benkler in the definition of rewards or punishments: profit, intentions, and process. Luck is the "magical" element that interferes due to its random component in any of these" (Huerva, 2017).

On the other hand, advances in AI make it possible to create virtual research environments on different group strategies and evaluate different scenarios. The Deepmind development team (Google's former artificial intelligence platform) investigated patterns of cooperation and competitiveness in other ecosystems with different learning algorithms, cognition, and game objectives, intending to understand social behavior against diverse environments and ecosystems (Joel et al., 2017). The prisoner's dilemma shows the paradox of individual action (social dilemma); it defines the behavior of the action as a rational agent, under the prism of the Game Theory, leaving other types of conduct in the sphere of irrationality. Until now, the studies focus on a binary decision (cooperate or compete in each agent) as an atomized action where cooperation makes possible better gains for the group that they could not obtain alone; and taking into account actions such as free-riding or distorting strategies (power actions) that involve the tragedy of the commons and threaten the balance of the community.

Nevertheless, cooperating or competing may require more complex behaviors, including more difficult sequences of actions that agents need to learn to do, also accepting that the ability to collaborate requires not only an elementary action but actions (policies) that are acquired and reproduced through social learning. The researchers base this process on Sequential Social Dilemmas (SSD) and create an environment where agents learn from another agent's actions (policies). A scheme like the classic dilemma is established from the social dilemma game matrix, Matrix Game Social Dilemmas (MGSD) (Joel et al., 2017).

Various studies show that the individual decision-making process is not based solely on the agent's experience (Laurent et al., 2011; Matignon et al., 2012). So, a vision must be added where it is important not only what the agents learn by themselves but also what the other agents learn. In other words, how does what other agents know to affect the agent? Markov chains are programmed on the SSD, which generate states (states) by collecting information (labels), in a Multi-Agent Learning (MAL) environment and which define the actions (policies) that the agents will carry out (Joel et al., 2017). Based on this scheme, Deepmind was then programmed for a game called gathering -a game framework was established- an environment full of apples where each agent had a laser and the goal was to collect more apples than the adversaries. The researchers wanted to see how the agents used cooperative or aggressive strategies to achieve their goals. In that test, it was shown that when there were many apples, the agents did not use the laser, but as the apples were being collected, the use of the laser increased intensely. This environment shows that in scarcity of resources, aggressiveness and competitiveness rises, and therefore learning from others becomes minimal.

Subsequently, Deepmind was programmed to execute a game called wolfpack, where the agents were wolves who had to hunt prey through a joint reward (the prey) that was distributed in the radius where the prey had been caught (non-individual reward), and where cooperation becomes the critical success factor in getting the prey. Social learning becomes more critical in this case because hunting in a complex environment requires social coordination. Social learning is not an essential requirement to achieve the goal of the gathering game. Agents do not need coordination between them. It must be considered that behind the cooperative action, there are also psychological variables that bring out different attitudes towards cooperation and that foster cohesion; these are variables that are added to the game models and arise from group behaviors (Kortenkamp et al., 2006). It is appreciated that complex environments give rise to more complex attitudes, such as trust and affection, resolves complexity, and add complexity, so behavioral changes allow for greater levels of complexity to be covered. It can also be seen that the negative interdependence between agents determines that one wins and the other loses (competitiveness). As well as positive interdependence, or interdependence correlation, which determines that both win (cooperation) (Johnson et al., 2014).

Gorodnichenko & Roland's analysis of individualism and collectivism is also important. Based on Geert Hofstede's Cultural Dimensions (Hofstede, 2011), they affirm that: 1) social prestige is greater in individualistic cultures than in collectivist cultures. 2) the collectivist culture provides a competitive advantage in producing goods because collectivism facilitates coordinated actions. 3) The greater coordination capacities of collectivism led to greater economic efficiency. 4) Individualism results in more innovation; in an individualistic culture, individuals have not only a monetary reward for innovation but also a social status reward and therefore assign more work to innovative activities. 6) The higher rate of innovation in an individualistic culture leads to higher productivity levels in the long run than in a collectivist culture (Gorodnichenko & Roland, 2011).

The researcher starts questioning himself about the set of variables to measure the cultural dimensions of Hofstede (Hofstede, 2011), and how to monitor the social change by means of sets of variables. How to monitor society.

10.2 Defining the Individual through Social Learning

According to Hofstede (Hofstede et al., 2005), culture is "the collective programming of the mind that distinguishes the members of one group or category of people from others." And "Such programming or "software of the mind" refers to the integrated patterns of human knowledge, beliefs and behaviors learned and transmitted through generations. It comprises symbols, social orders, attitudes, goals, practices, and values" (Tapanes et al., 2009). Studies on human action highlight that individual action[32] strategies pass mainly through the collection of social information and that this is obtained through social interaction (Pentland, 2015). Pentland shows that individuals with similar age, gender, religion, and job characteristics may tend to download an app more or less accurately. But, if there is also face-to-face contact, phone calls, or shared social networks between these same individuals, the prediction accuracy of which App will be downloaded increases up to 48% (this is part of the explanation). In addition, if individuals see others adopt strategies similar to theirs, they become more confident in their strategy, increase it, and lower the collection of social information (they become more competitive and less open) since, at the moment, as the environment becomes more familiar, the collection of social information becomes less important. On the contrary, if individuals do not know what is happening in their environment, they spend all their time collecting social information to understand it and achieve security (they become more cooperative and open) (Pentland, 2015; Huerva, 2018). At the same time, Lawrence and Lorsch state that in a stable context, there are

[32] The bibliographic study shows that the scientific value that has been given to observing the individual's dynamics through metadata has been extensive. And much of the literature about its application may be influenced by thinking based on Rational Choice Theory since it is a theory that ambiguously can be easily extrapolated to the economic or power interests.

less innovation, less competitivity, and rigid organization; on the contrary, in an unstable context, there is more innovation, fast changes, and more flexibility (Lawrence & Lorsch, 1967).

"It is appreciated that social learning becomes an action of habit, and preferences and ways of acting are defined mainly by the behaviors surrounding individuals. This shows that social learning becomes a natural process where the individual essentially copies and applies the action according to the success or failure of others who have carried out said action. Since they copy based on the success or not of others, combined with individual learning[33], many more chances of success are obtained than not only individually. All this scientific work shows the importance of society in individual human development, and this does not contradict the process of individualism in which the human being has been immersed (Beck, 2003), coming to understand that the social environment is an important conditioning factor of our individualization" (Huerva, 2018).

10.3 Diversity and Consensus

In addition, also citing the dissertation, "(...) in one of the experiments carried out in investment communities, Alex Pentland (Pentland, 2015) states that users who have more social information do have a diversity of connections, different groups of thought and diversity of ideas, they achieve a profitability of 30% higher than the rest of the members of the entire community". (Huerva, 2018).

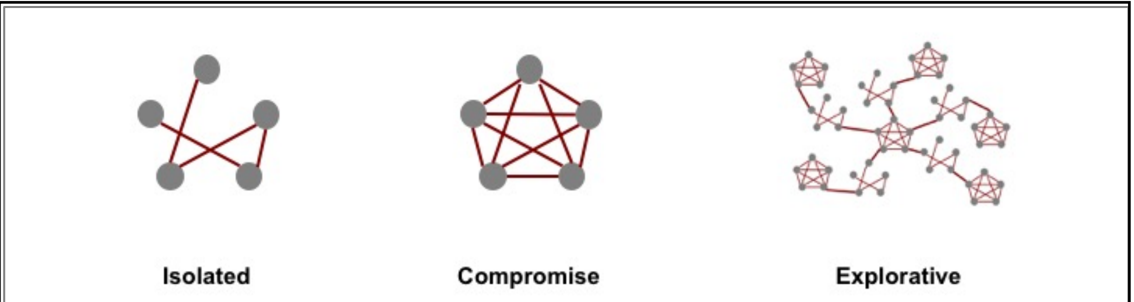

Figure 8. relationship networks. Source: Own elaboration based on Alex Pentland (2015). The schematic on the left shows a centralized form of exploration.

In Fig. 8, the left scheme corresponds to an isolated group with a low level of information and low levels of trust, Unlike the scheme in the center, like a clique, the increase in information connections leads to higher levels of trust in it, turning this scheme into a cohesive network. Even very confident, this network can fall into an ideological bubble of thought (group thinking). The way to promote the breadth of information and exploration is through the sum of the two schemes

[33] The cognitive way of interpreting your success -of the other-, to what is your mistake -of the other-. A cognitive system is not a tabula rasa; the punishments for one can be interpreted as rewards for another.

since the isolated schemes act as a link between different broader groups of thought". (Huerva, 2018). It is appreciated that the larger the clique, the larger the cohesion.

The importance of collective intelligence is also highlighted as an emerging element for collective decision-making."(...) An important aspect that marks a trajectory as a society is that the more significant heterogeneity, the greater the capacity for social advancement, which is also found in other studies on social behavior and joint decision-making (Surowiecki, 2004). Moreover, it is the collective intelligence necessary to solve the challenges in which society finds itself today. This does not have a strong connection with the average or maximum individual intelligence of the members of the group (Woolley et al., 2010; Aggarwal & Woolley, 2013), however, is correlated with 1) The average "social sensitivity" of the group members, the way they empathize and understand the points of view of others. 2) Equality in the distribution of speaking turns and conversations since groups when the word is kept to only a few members show lower levels of collective intelligence. 3) The proportion of women in the group since the groups with more women obtained higher values of social sensitivity.

Anita Woolley also highlights that individuals with similar opinions show a high probability of having similar sources of information, an important element if maintaining the same idea in a group is equivalent to improving levels of trust and commitment. However, it also positions the group in a convergence of thought (group thinking), a factor that plays to the detriment of collective intelligence (Pentland et al., 2013). In such a way, it cannot be affirmed that the more significant social interaction is equal to greater collective intelligence -due to echo chambers or group thinking-. However, it can be established that the more interaction, the greater the possibilities of diffusion of information, of different ideas, and, therefore, greater chances of progressing in collective intelligence." (Huerva, 2018).

10.4 Cognition and feelings

It is essential in analyzing the dynamic forms of interrelation that the individual cognitive system is "unique"; it is not a "blank tabula" without established norms or laws (Goddard, 2012; Kihlstrom & Park, 2018; Elazar et al., 2022). It is the magic of the cognitive system interpretation; given the same stimulus or information, there are always averages, but different people understand different information and can feel different things. Individual cognition is an adaptative element to the ecosystem; it interprets and transforms reality; in this way, diverse individual cognitions can interpret and transform the ecosystem better; more diversity equals to more ways to understand more complexity.

Initially, the Cognitive Balance Theory is analyzed, developed by Fritz Heider and Leon Festinger, described as: "If strong ties A-B and A-C exist, and if B and C are aware of one another, anything short of a positive tie would introduce a "psychological strain" into the situation since C will want his own feelings to be congruent with those of his good friend, A, and similarly, for B and his friend, A. Where the ties are weak, however, such consistency is psychologically less crucial" (Granovetter, 1973). Georg Simmel describes it as a form of socialization, the triadic Closure (Simmel 1908). It is a triadic relationship scheme between individuals, where a cognitive balance is achieved if there are three positive relationships (we all love each other), or one is positive, and two are negative (my enemy's enemy is my friend). Cognitive imbalance occurs when there are two positives and one negative, which is generated by stress. A balance will be sought[34] (compensatory function); the two positives tend to convert the negative into the positive (Huerva, 2018). The process of cognitive dissonance leads to explaining and fixing an imbalance in the physical and social contexts, this dissonance is a source of innovation, and social and physical tools are used to address and balance this dissonance.

Guillén states that human beings are good at compartmentalizing information, and they classify it to avoid cognitive dissonance, this generates stress and conflict; life is organized into categories to reduce complexity so that plans can be made and predicted (Guillén, 2020). The researcher speculates that these categories are used to create the frames of reference. In this way, frames would be sets of categories. Frames are used to compartment information, to structure it. Frames compose frames, there are relationships between them, some change, and some are constructed over others that don't change. We are frame creators, and we create bigger frame structures along life. The research speculates that framing structures in the human mind are becoming more complex as well, especially compared to someone of the XVIII century (e.g.). As games, frames explain human beings, and the analysis of frames should give more information about individuals and society, the arising challenge of this research is how to capture the frames.

The researcher also analyzes the relationship between emotions and rationality through the work of Jon Elster (Elster, 1989; 2007). Emotion can generate desire, and desire can generate action, similar to the relationship between thought, intentionality, and action described by Alexander Rosenberg (hermeneutic triangle). An emotion, a thought, a desire, or an intention does not determine whether a specific action or habit is produced, but these elements can influence the action (Rosenberg, 2016). Also, studying the *Thinking Fast and Slow* proposal (Kahneman, 2011) where "System one is fast, automatic, and system two is slow, deliberate, conscious. A model that questions the other system in the way of an antithesis and tries to refute it to accept whether the information is viable or applicable. In addition, it is the one that converts the feelings and patterns of ideas into thoughts in the system one. It feeds system one, develops the timeline that creates the past and future and is activated when the normality of the world created by system one is disrupted. The cognitive system works mainly based on social relationships, which needs society to develop correctly." (Huerva, 2018). The researcher

[34] Same theory has been extrapolated to studies on how celebrities (famous people) affect the purchase of a product (Mowen & Brown, 1981; Silvera & Austad, 2004; Duthie et al., 2017; Knoll & Mathes, 2017); but instead of individuals also with objects, and the results are significant. (Huerva, 2018).

speculates that the definition of these two systems also configures the norm's framework of everyone.

10.5 Interdependence, Cohesion, and Social Learning

Although all this knowledge has an extrapolation to the economic world, especially when the aspect of "rewards and punishments" is related to consumer techniques (marketing), it does not exclude that, behind all of this knowledge, It can be extracted that when the cooperative action is maintained synchronously, all the individuals know what the others are doing and trust each other, commitment is generated, and this commitment generates endorphins. This natural opiate gives pleasure as a reward for the fact of working together, dancing together, or watching a show together (Calvó-Armengol & Jackson, 2010; Huerva, 2017).

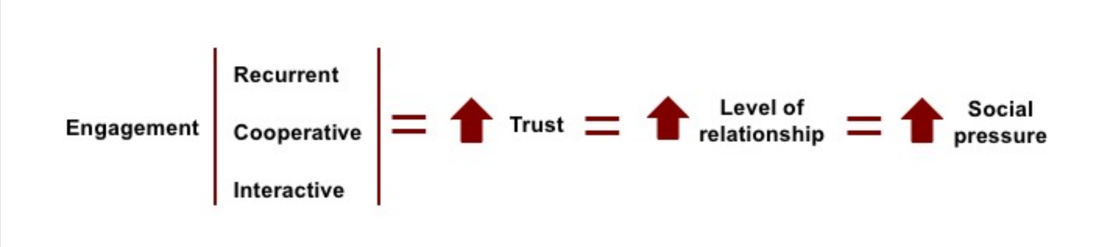

Figure 9. Relationship between commitment and social pressure. Source: Own elaboration based on the reading of Calvó-Armengol & Jackson, (2010). Source: (Huerva, 2018)

It is also extracted that the punishments and rewards in the interactions of small groups of individuals are much more effective than not in large groups. Also, the individuals who receive more incentives from their network are, at the same time, those who have greater interaction with the rest of the individuals and generate greater social pressure (Mani et al. 2013). And regarding this, it is a fact that in relationships where there is a direct vision between individuals, their commitment presents higher levels; as well as the workgroups obtained higher creativity quotes. But at the same time, it must be considered that direct vision between individuals can also coerce their attitude. In addition, cooperative action is more elevated when personal social ties preexist.

It is no less important to understand that distance and the locality previously seen in nationalism as other factors to consider measuring the commitment in a network of individuals. If the objective is focused on research on social pressure, it can be observed that the greater the distance between individuals in a network, the lower their commitment[35] (Ibid.). Mani and his team show as an example the users of an electric company whose consumption is compared with the consumption of the rest of the country; users did not reduce their consumption. Subsequently,

[35] The lower weight of the individual among others, or the individual feels more diluted among the rest.

their consumption was compared with the rest of the users in the neighborhood, and then the users appeared to lower their consumption. The consumption reduction was more remarkable when the comparison shown to the users were within the same street they lived. The most considerable reductions in consumption were recorded when their consumption was shown in comparison with the neighbors of the same building." (Huerva, 2018). This is linked with Frederic Laloux's reading: "When trust is extended, it breeds responsibility in return. Emulation and peer pressure regulate the system better than hierarchy ever could" (Laloux, 2014).

"Social interdependence theory postulates that individuals are motivated to achieve to receive rewards from others and this motivation is stronger when the rewards come from people with whom the individual has a close relationship" (Johnson & Johnson, 2009; OpenAI, 2022). Kurt Lewin proposes that the essence of a group is the interdependence among the members, which results in the group being a dynamic whole such that a change in the state of any member or subgroup changes the state of any other member or subgroup (Lewin, 1935; 1948). Group members become interdependent through shared goals. The basic premise of social interdependence theory is that how the purposes of the participants are structured determines how they interact, and the interaction pattern determines the situation's outcomes (Deutsch, 1949; German, 1962; Johnson & Johnson, 2009).

As already observed, there are two types of social interdependence: positive, when the actions of individuals promote the achievement of joint goals; and negative, when the actions of individuals obstruct the achievement of the objectives of others. Deutsch (Deutsch, 1949, 1962) states that positive interdependence creates the psychological processes of substitutability (that is, the degree to which one person's actions substitute for another person's actions), positive cathexis (the investment of positive psychological energy in objects external to oneself, such as friends, family, and work), and inducibility (openness to being influenced by and influencing others). Negative interdependence tends to create irreplaceability, negative cathexis, and resistance to influence. No interdependence can be characterized by the absence of these three psychological processes (Johnson & Johnson, 2009).

Social interdependence must be differentiated from a) social dependence, b) independence, and c) powerlessness. Social dependency exists when Person A's goal achievement is affected by Person B's actions, not vice versa. Social independence exists when Person A's goal achievement is unaffected by Person B's actions and vice versa. Social powerlessness exists when neither the person nor others can influence the achievement of the goal. In Johnson & Johnson's research on the implementation of cooperation, they posit five variables that affect the effectiveness of cooperation: 1. Positive interdependence, 2. Individual responsibility, 3. Fostering interaction, 4. Appropriate use of social skills, and 5. Group processing (Johnson & Johnson, 2009).

"Alex Pentland affirms that the determining factors of human behavior are a) Influence of genes. b) IQ and academic performance. c) Exposure to behaviors in the environment (contextual), and the latter has more weight than the other two (Pentland et al., 2013). The researcher infers that in "c" are aspects such as inequality, which ultimately conditions "b." Although "averages" can always be found, it should not be generalized; society allows different classifications and types of behavior, configuring its dynamics. Basically, it shows that there is a diversity of actions, diversity of rationality, diversity of cognitions, and heterogeneity. And, the individuals that surround people -society- exert a vital force in individual decisions, in front of a context that also conditions social action as an individual, and their interpretation of the context (frame)" (Huerva, 2018).

10.6 The OCEAN Model

The Cambridge Analytica scandal evidenced that the classification model they used was effective; it was based on the Openness Consciousness Extroversion Agreeableness Neuroticism (OCEAN) model, which allows the definition of a psychological profile according to the capture of a series of characteristics. It is noted that Cattell was the first to search for and define a set of factors that capture human psychology (Cattell, 1947). (Goldberg, 1990) and (DeYoung, 2006) are considered for the model definition, as well as Egge's teamwork for creating a simulation model to capture and classify personality characteristics using OCEAN (Egges et al., 2003). It is observed that the OCEAN classification model can also correlate with physical activity (Rhodes & Smith, 2006). As well the methodology's trajectory and its application to social networks (Marengo et al., 2020) are considered. The exciting aspect about the OCEAN model is that it can be applied to a High-Density Autonomous Crowds (HiDAC) computing environment and show the predictability of behavior in defined contexts (Allbeck & Badler, 2008; Durupinar et al., 2009). It is also important to mention the studies on how to measure ideology (Berry et al., 2010) or the prediction of habits and individual characteristics through Facebook likes (Kosinski et al., 2013; Kurz & König, 2022).

10.7 Tensegrity

Turnbull (Turnbull, 2010; 2020) also describes tensegrity, something that the researcher has already seen in Lewin (Lewin, 1935), as the ability to combine contrasting elements for a common function, for a balance. A definition that bears similarities with the principle of dialogic; and is present throughout the dissertation. For Turnbull himself, the holonic architecture introduces social tensegrity since it provides the most efficient way of regulating complexity while economizing the byte transaction. (...) "Holonic governance in civil society provides a way to enrich the freedoms of individuals while enriching their participation in the results of how they are governed" (Turnbull, 2010).

At this point, the researcher analyzes social tensegrity (Primus, 2022) and understands the relationships that may exist between the concepts of physical and social tensegrity. In tensegrity, there is no centrality; all the elements make up centrality. Tensegrity are the forces, mechanisms and structures that unite the parts and form an indeterminate unit (indeterminate form), but showing a balance (equilibrium geometry), through forces (state of self-tension).

A concept that can be applied to a cell (Ingber, 2003), structures, the individual, or society (Hermans al., 2017). "The psyche should understood in terms of a tensegrity system: that is, a system in which the organizing principle is not balance and homeostasis but dynamic tension. In this type of system, endogenous and exogenous forces, tensions and compressions act to create a state of tensegrity (Tateo & Marsico, 2013) in which the integrity of the organism is based on a state of constant dynamic pretension that ensures both flexibility and stability over time" (Ibid.).

Marsico & Tateo define a model to explain the society where tensegrity is a crucial element: "By applying the conceptual triad [borders, co-genetic and tensegrity] to the Dialogical Self Theory, we try to expand the understanding of the Self-system. We started this article by discussing the interesting development of the model proposed by Hermans et al. (2017) who refer to the metaphor of democratic society of the Self to understand the challenges and possible direction of adaptation that the persons can face in the contemporary globalizing society" (Marsico & Tateo, 2017). These authors define society by the set of its barriers (locality), similarity (co-genetic), and forces exerted (tensegrity). In any case, the researcher understands tensegrity as the forces in tension that maintain the structure and define the limits of a society, the set of transformations and feedback processes (forces) that exist in a society to develop in a context.

10.8 Relationship Scheme

With all these concepts and relationships, one can start to configure a first version of a relationship between concepts and dimensions to measure. And where habits can be associated with behaviors, and through a comparison of habits and the analysis of the change in habits, social change can also be understood. The analysis of change is the methodology to monitor society.

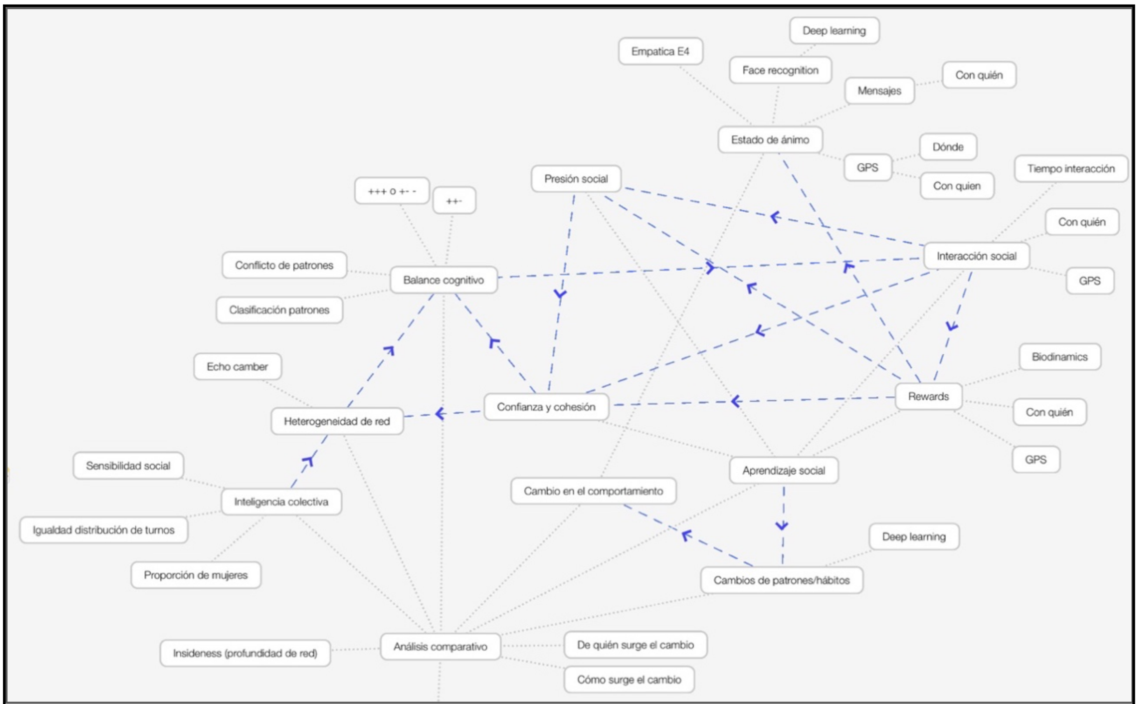

Figure 10. The scheme on the interrelation of concepts analyzed. In (X), color is the way to capture the concepts. Source: Based on previous work (Huerva, 2018).

The schema in Fig. 10 shows a relationship between the observed concepts to monitor collective intelligence, network heterogeneity, cognitive balance, behavior change, social learning, trust levels, rewards and punishments, moods, or social pressure. The crucial challenge is to find a way to capture the right data to compose the relational schema. This schema relates individual and social information, showing individual and social contexts, and the more contextual information is added, the more information about the relationships will be obtained. In addition, obtaining more sources or data entries will increase its accuracy. Contextual information can be inferred thanks to Open-Source Intelligence (OSINT) techniques, used mainly in national security and defense, through the use of data from open sources. It is a schema based on the crossing of many data sources.

11 Complexity

At this point, the researcher finds plausible that the way to relate these concepts and control complexity could exist through current capture and processing data technologies. Throughout this work, a recursive relationship has been observed between physical and social technologies and physical and social contexts, allowing the configuration of new forms of governance or ways to organize and explain complexity. A relationship that has allowed new ways of organizing, generating interdependencies, understanding relationships, and development. This recursive relationship makes us realize that what was previously impossible using old physical and social tools is now a reality because we have better physical and social tools. Through this principle, current technologies can define new forms of social organization that are impossible to imagine nowadays.

11.1 The Third Wave of Complexity

In his book, *Social Emergence: Society as Complex Systems* (Sawyer, 2005), Keith Sawyer defines emergence and outlines the trajectory of complex thought. A work that discerns the approach to complexity in three waves, which bears similarities with the research process that the researcher has developed from Morin[36]. Sawyer describes the three waves:

- The first originates with cybernetics, and Parsons pioneered the Cybernetic Systems Theory to Sociology, a wave characterized by hierarchical structures.
- Biological models characterize the second wave and amalgamate scientific disciplines. It is defined as Systems Thinking Theory and includes Chaos Theory, from which the non-linearity of systems arises. "Chaotic equations are a specific type of non-linear equations" (Ibid.); non-linearity represents the non-proportionality between causes and effects. Thus, small causes have significant consequences. As seen then, Chaos Theory grants a dynamic characteristic to the understanding of society.
- The third wave includes complexity and social emergency and is renamed the Theory of Complex Adaptive Systems or Complex Dynamic Systems.

Sawyer also draws a scheme that defines the theoretical elements that describe the third-wave approach to complexity. This has been of great help in validating that the path followed by the research from now is correct. The structure that follows the argument of this dissertation is based on an exploratory approach and reaches a logic that Sawyer calls Emergence in self-organizing Systems.

[36] Corroborates that the logic that follows the dissertation is not wrong.

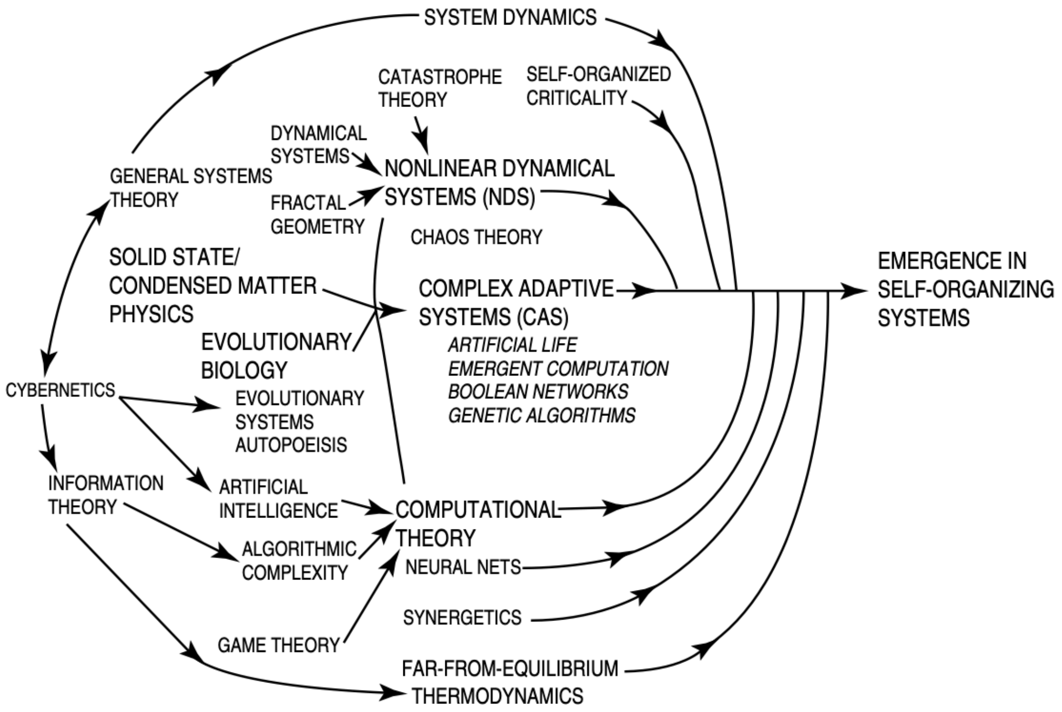

Figure 11. Scheme of the third-wave approach to complexity (Sawyer, 2005), which, in turn, was devised based on the work of Goldstein (Goldstein, 1999).

As will be seen, the logic of this research continues exploring Systems Theory, living systems, and forms of interdependence and feedback. From there, the exploration goes to self-organization, to later understand that cybernetics can control the feedback of interdependence. And from there, move on to emerging systems.

11.2 Holistic and Individualistic Perspectives for Social Analysis

Norbert Elias states that the traditional way of studying an object is based on dissection, isolation, and studying the elements that compose it by their characteristics. If society is studied, individuals, their psychology, and behavior are examined. Elias calls it atomism and suggests that it is not the best way to approach an object of study since it focuses on the elements but not on the interdependencies of the elements. And although both perspectives share this point of view, the same author calls the holistic view that the set is more than the sum of its parts an "aberration" (Elias, 1998). Watkins (Watkins, 1968) reflects the general philosophical perspective that individualism and holism are both exhaustive and mutually exclusive (Ritzer & Gindoff, 1992)

Elias explains interdependence through two elements: 1) power and 2) game structures, which he names "contests." It is also appreciated that functionality comes from interdependence, "we can only speak of social functions when referring to interdependencies which constrain people to a greater or lesser extent" (Ibid.). As has been said, it focuses on social interdependence through game dynamics and power dynamics. It is essential to understanding society, not only as subjects but also as relationships between subjects.

It should be noted that, from an anthropological perspective of cultural materialism, Elwell (Elwell, 2013) cites Marvin Harris proposing infrastructural determinism, formally called primacy of structure, which distinguishes: a) Infrastructure such as production and population. b) Structure as a political organization, social organization, corporation, and c) Superstructure as values, concepts, beliefs, norms, and symbols (Harris, 1974).

The perspective of the General Systems Theory (GST) arose already in classical times with Aristotle. It was further developed by Bertalanffy and Weiss in the 20th century, from initially a very biologistic conception, quickly passed to other scientific disciplines: "The physical world is not simply a sum of unique spatial and temporal worlds running side by side, and many phenomena are beyond comprehension when one does not consider a physical object as a whole" (Planck, 1929).

11.2.1 Introduction to GST

“An organization is defined as a system of interrelated behaviors of people who are performing a task that has been differentiated into several distinct subsystems, each sub-system preforming a portion of the task, and the efforts of each being integrated to achieve effective performance of the system” (Lawrence & Lorsch, 1967).

Suppose the analysis is taken from an organic perspective. In that case, an organism is an organization unit comprising many other organization units and other organisms. At the same time, all are made up of other organisms. The organization is the joint action of living systems, not inert; living systems are open systems. The General Systems Theory (GST) uses theoretical frameworks from thermodynamics, biology, or Information and Networks Theory. And affirms that the elements that make up the systems cannot be described in terms of their separate parts; "In most cases, the set has properties that cannot be known from the analysis of the constituent elements in isolation" (László, 1972). The understanding of systems only occurs when they are studied globally, involving all the interdependencies of their parts; none of the parts is independent of the system. This is why a system "is more than the sum of its elements" due to the synergy and emergence that they present (Kauffman, 1980).

Ervin László further explains that the new systems view of organized complexity was "a step beyond the Newtonian view of organized simplicity," which reduced the parts to the whole or understood the whole unrelated to the parts (László, 1972). The relationship between organizations and their environments can be seen as the primary source of complexity and interdependence. Weiss defines a system as: "(...) an empirical entity that, according to our experience, has a sufficiently durable identity to be defined on a macro scale as a whole, although, from our knowledge of the parts only in which we can physically or mentally fractioning the entity on the microscale, we will never recover the rule of order discernible in the intact macrosystem"

(Weiss 1971). And as "a complex unit in space and time constituted in such a way that its component subunits, by "systematic" cooperation, preserve their integral configuration of structure and behavior and tend to restore it after non-destructive perturbations" (Ibid.; Drack & Wolkenhauer, 2011).

Three premises can be distinguished from Systems Theory: 1) Systems exist within systems, 2) living systems are open, and 3) the functions of a system depend on its structure. In addition, the systems are differentiated according to their hierarchical complexity in a) suprasystem, b) system and c) subsystem. Moreover, these are not independent of each other. It is a theory that expresses recursive and hologrammatic principles.

The spatiotemporal arrangement of the elements and relationships determines the structure, while the function of a system is defined as the order inherent to the interactions (Bahg, 1990); they are also classified by: a) their responsiveness, b) their internal dynamics, c) its level of dependency, d) its default function, and e) its type of interaction (Müller, 1992). Müller also summarizes some common aspects of this research (ibid). Several systems can present equifinality, or what is the same, several initially different systems can reach the same final states, as well as equicausality, referring to the fact that several initially equal systems can end up in totally different states (Katz & Kahn, 1978; Political Complexity, 2020).

The organization is the action of living systems, not of inert ones. In that case, it can be affirmed that the living system requires a type of open interaction for an organization to adapt better. The systems whose interaction is open allow transfers of information, energy, or matter outside their system in the surrounding environment, adapting to and influencing it; open systems interact with their environments. The system builds or breaks down its structure (transformation) depending on the information it receives from its environment (feedback). Open systems are also related to the self-organization process: the information and resources received from the environment allow the elements within the system to self-organize into new structures, which are better adapted to the environment. (Laszlo, 1972). In general, these systems are more scalable and manage complexity better. These are also more dynamic, facing unpredictable environmental changes and having lower hierarchy levels. Open social systems are transparent and reveal hidden corruption, incompetence, and malpractice. However, these are also characterized because they can present incompatibilities with closed systems, forms of independence, borders, and centralized systems. Closed-type interaction systems do not allow information, energy, or matter transfers outside their system; they are isolated from their contexts and closed from their environment, or feedback between the system and its environment is limited. Closed systems have a lack of adaptability and are more deterministic by nature.

Kenneth Boulding defines nine types of structures in systems, 1) static, 2) mechanical, 3) equilibrium, 4) reproductive, 5) associative genetics, 6) animal, 7) human, 8) social organizations and 9) transcendental (Boulding, 1956). Systems show reciprocal codetermination or circular causation (Von Bertalanffy, 1950), this reminds the researcher of Morin's recursivity principle.

Simms defines ten principles of behavior of living systems (Simms, 2006):

1. The behaviors of living systems are observable and measurable through the energies used in these behaviors.
2. Living systems have a unique behavioral characteristic: the ability to direct energy.
3. The ability of a system to direct energy is a function of its structure and organization.
4. The ability of a system to direct energy can be quantified (measured or calculated).
5. The behavior of a system is a function of the energy available to the system.
6. The behavior of a living system is a function of behavioral information.
7. Behavioral information is the ability to generate work and can be measured by its work.
8. The behavior of a living system is a function of its knowledge.
9. Knowledge is the capacity to generate information and can be quantified by the amount of information.

According to these definitions, classifications, and principles, the researcher re-understands society as a living system; the organization is a living system, has living behavior, and a proper behavior composed of multiple behaviors (hologrammatic principle). Life is not static, it changes, *panta rei*, and it seems that it tends to encompass and generate complexity. It is essential to understand that systems develop forms of interconnection and functioning among themselves, consolidating and predetermining forms. These forms are considered limitations because they delimit the tree of options in which the system is projected. At the same time, these allow the consolidation of the system to cover new limits in the context.

Systems require energy, energy determines the system, and the energy transformation process of a system is vital to encompass greater context and complexity.

Open systems have relationship mechanisms and follow a homeostasis (balance) process, where clashes occur between forces that maintain balance and control the current state, forces of change (Political Complexity, 2020). The analysis understands that these limitations to which it refers and defines the system are shown through their transformation processes and positive or negative feedback, showing the behavior by means of the forms of interdependence.

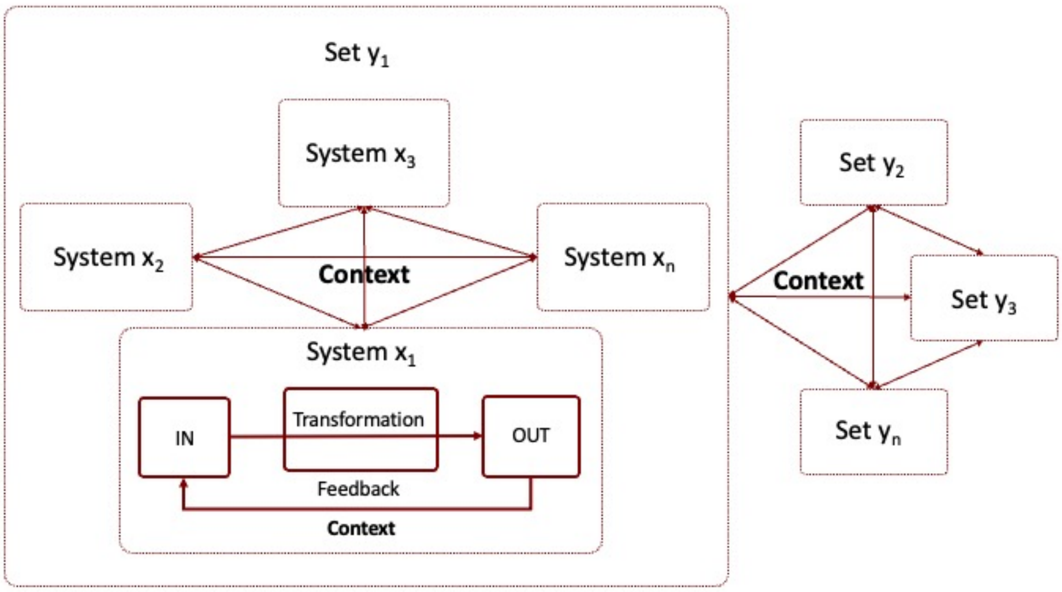

Figure 12. Shows the logical scheme of a system and the relationship with the context. It has an energy or information input, a processing or transformation element, an output or functionality, and a feedback or control return. The context comprises other open systems with their input, transformation, output, and feedback processes; -in (Lawrence and Lorsch 1967) subsystems- it adds complexity as the systems interact. In other words, input and output not only arise from a system's transformation and feedback process but from several systems since more systems conform the context. This schematic is also an example of a basic cybernetic schematic.

There is a relevant aspect when analyzing the GST, Weiss and Bertalanffy were skeptical about a merely mechanistic vision of the organism, and contrary to the notion of the organism as a machine, "there is more than mechanics" (Drack et al., 2007). The mechanical process of social organization is argued by Institutional Theory, which studies, among others, the process of mechanization and social rationalization. The existence of mechanical processes should not exclude the existence of other dynamics and processes. The mechanism means some easily understandable causal sequence that explains some theoretically explained pattern (Lundberg, 1939) and a specific kind of plausible argument associated with reducing potentially visible and understandable events if these events are never observed (Martin, 2003).

11.2.2 Criticism of the Methodological Perspectives

There is no criticism of Systems Theory nor methodological individualism in this research; the criticism is their lack of relationship, the space between them. The distinction between schools of thought or macro-micro analysis methodologies is essential, micro-macro responds to reality from different perspectives. The study of processes and isolated parts leaves aside the organization, a fundamental characteristic of life, in terms of structure and function (Drack & Wolkenhauer, 2011). Like Weiss, the researcher does not believe in the one-sidedness of both "holism" and "individualism" because living entities must be approached from both micro and macro perspectives (Weiss, 1978).

To affirm, "society is the set of organizations between individuals" responds to a macro-micro perspective, just as "individuals are the set of organizations of society" responds to a micro-macro perspective. Both explain the same thing, the individual explains the organization, and the organization explains the individual (hologrammatic principle). But there comes the point where the macro-micro perspective stops explaining, just as the micro-micro perspective does. Two opposed perspectives have a difficult relationship, and criticism comes precisely for this reason, this delimitation that both present and their consequent complex relationship between them (Ritzer & Gindoff, 1992; Sztompka, 1994). As previously explained, technologies would allow new perspectives to understand the individual and society without this type of limitation. This is why the research is trying to find new ways to understand society with the same scale or metrics: a methodology to measure society from the individual to the society and vice-versa.

It must be said that this research presents a teleology, the functionality or purpose of the entire system; if there is a design, there is a designer. The researcher assumes that if there is a human system design, there are human system designers. All the humans. A system where laws, processes, mechanics, power, and stochastics come together and whose functionality is human.

11.3 Self-Organization

The researcher considers the work of Dijn (Dijn, 2020); in classical conception, freedom was understood as the absence of foreign government and was equated with self-government or the people's ability to control how they were governed[37]. Or the ability to be governed by the people themselves, not by the people from another village. So, the study relates self-organization as a way to freedom.

In the GST, self-regulation is assumed as a fundamental element for balance. Miller affirms that no system can exist without self-regulation (Miller, 1965). It is still the way to interact and adapt to a simple or complex environment through the information perceived. But the researcher notes that when he reads about the applications of human self-organization, these are shown with a connotation of urgency, an urgency due to non-organization. In such a way, the self-organized forms would only arise if there were no established order or if this order does not respond to the requirements of the set. The researcher questions why.

1). The researcher considers that part of the explanation has a power dynamic. 2). If these are temporary, it is because the greater self-organization requires more energy than the lesser self-organization. More self-organization equals more energy, and less self-organization

[37] This freedom, in a positive sense, drove the actions of Athenian democrats, Roman plebeians, Florentine humanists, and American revolutionaries in their struggle against existing power structures (Krause, 2021; Halldenius, 2022).

requires less energy. 3). And, finally, understands that one implies the other; in such a way, it is always self-organization, although to a greater or lesser degree. The first arises from the historicist analysis, the second from the analysis of GST and thermodynamics, and the third from the Complex Thought Theory.

Ashby is the primary source when analyzing self-organized systems; he differentiates between two forms: the first consists of linked simple systems, creating a complex system that interacts autonomously with the context. The second is a system that changes by itself, from a bad organization or not appropriate to the context, to one that offers a better response to the context. The system changes the organization through a transformation process that will respond to positive or negative feedback. Ashby defines some principles of self-organization based on mechanistic logic and information technology (Ashby, 1991):

1) The function is essential, all the parts must have the same function; the analysis considers that this principle is applied in the sense that, for there to be self-regulation, all the self-organized agents must have the same function or information, the same objective.
2) The system must write itself, mutate, and change its interdependencies.
3) No system can be fully self-organizing, just as any system requires self-organization. The analysis identifies the principle of recursion.
4) Any dynamic system generates its intelligence; it self-organizes in this way.
5) Each determined isolated dynamic system that obeys immutable laws will develop organisms that adapt to their contexts.
6) The balance in simple systems is much easier than in complex systems; these require greater interdependence.

In addition, it is observed that a linear increase in energy can produce a non-linear change in the system; self-organizing systems require high interdependence, both positive and negative feedback control. In such a way that, as interdependencies are added, the energy level needed for the system can be non-linear. There is a relationship between emerging systems and self-organization and the increase in complexity when self-organization is generated (Paradisi et al., 2015).

In Turnbull's book Design Concepts for Governance Architecture, the author mentions: "While evolution has equipped humans to become more autonomous individuals, their culture may prevent them from forming autonomous organizations. This prevents minimizing the role and size of the government. Societies in prehistory were autonomous without government" (Turnbull, 2010). Self-government may be the natural form of an individual organization, but the cultural and social structure defines another form of organization.

11.4 Cybernetics

The word cybernetics comes from the Greek kybernetes and means the art of sailing a ship. Plato used this word in *Book VI*, in the dialogue with Ademantus, with the meaning of the art of directing men or the art of governing. Wiener coins the term as the science of control (Laszlo, 1972). Bertalanffy and Laszlo refer to cybernetic systems as schemes for responding to self-organized forms. Cybernetic systems refer to the dynamic feedback process through inputs and outputs; two types are distinguished: 1) The first focuses on studying self-stabilizing controls that work through negative feedback that reduce error. 2) The second focuses on the importance of error, or deviation, amplifying control processes that work through positive feedback. Costa de Beauregard defines the reactive dynamics of processing: "Willing awareness and learning awareness occur within progressing and regressing statistical and causality on the one hand, will and finality on the other" (Costa de Beauregard, 1968).

The current world can be made thanks to machines, and cybernetics is the scheme of interaction, interpretation of the context, and operating logic. This definition fits on a machine like a telephone, but also of an educational system (education process), on a legislative system (law process), and also the set of all (social machine). Where programs are used to find and categorize people and where the end of one automated process initiates another automated process. Cybernetics is based on the feedback process to maintain a given pattern. "(…) the difference between this pattern and the movement performed is used as a new input, to make the regulated part move in such a way as to bring its movement closer to that given by the pattern". Wiener describes that this so-called cybernetic process is carried out through information and feedback (Wiener, 1948). The form of control of a cybernetic system resides in the control of information flows -or energy- since the cybernetic process is an adaptive self-regulation process through feedback (Fig. 12).

11.5 Emergent Systems

The analysis of emergent systems also arises from the study of self-organization systems (Johnson, 2001) and the increase in complexity when self-organization is generated (Paradisi et al., 2015). Keith Sawyer deals with both aspects in Social Emergence: Societies as Complex Systems (Sawyer, 2005). When discussing emergent systems, slime mold has been used on several occasions to describe these systems, although Lansing also names the immune system (Lansing, 2003).

The slime mold is a simple organism; it has all the same cells, and no one is different from the others. Furthermore, the experiments by Nakagaki (Nakagaki et al., 2000) showed that the organism's behavior had an element of the decision. The scientific community assumed that it had to come from a cell that directed the rest to coordinate the action of the whole organism.

Some cells coordinate the rest or an element above the rest and decide. For years it was studied what that element was, or that "pacemaker" cell that directed the rest, but it was never found (Johnson, 2001). Moreover, it was not found because it does not exist in an emergent system.

In 1969 Keller and Segel affirmed that if each isolated cell secreted a compound, simply in its local perception of the general conditions of the external context, the community, or the rest of the slime mold cells, it was capable of aggregating based on global changes in the environment without an element in command (Ibid.). Considering the paradigm of centralized, hierarchical models at that time, the scientific community had difficulty understanding this aspect, "where is the founding cell?" (Ibid.). Not until later, a series of experiments showed that cells were organized from below; this is called bottom-up behavior. Holland analyzed how cities and the people in them were organized and was unconvinced by the "invisible hand" explanation to explain the market fluctuations (Lansing, 2003). Resnik developed computer simulations of the cell aggregation process, allowing him to observe the "invisible hand" of self-organization.

If Keller & Segel observed self-organization behavior, Jane Jacobs discovered it in the urban formation of neighborhoods and Marvin Minsky in the different human brain networks. An emergent system solves recurring problems for masses of relatively "unintelligent" elements rather than through an "intelligent" executing element. That is why these are bottom-up systems and not descendants; these draw their intelligence from the base (Sawyer, 2005). These are systems that display emergent behaviors (Nicolis & Prigogine, 1989); or Complex Adaptation Systems (CAS) (Holland, 1995; Lansing, 2003; Boal & Schultz, 2007; Miller & Scott, 2007).

CAS is a complex system defined by a dynamic network of interactions; the behavior of the whole cannot be predictable based on the behavior of the components. It is adaptive in the sense that individual and collective behavior mutates and self-organizes in correspondence with the micro events or set of events that initiate the change (Wikipedia, 2022). It is a "complex macroscopic collection" of "partially connected and relatively similar microstructures" formed to adapt to the changing environment and increase its survivability as a macrostructure (Miller & Scott, 2007). CAS can learn and have a replication dynamic that allows the entity to adapt and develop in the context. Exists different replication equations or algorithms from the quasispecies model describe the Darwinian chemical and biological process and include mutation from genotypes (Gross et al., 2014; Wikipedia, 2022). Or the replicator equation model, which represents an evolutionary game theory scheme, does not include the mutation element, cannot create new strategies, and is deterministic (Cressman & Tao, 2014; Wikipedia, 2022). In this type of system, the agents that reside on a scale begin to produce behaviors that lie on a higher scale than their own. Ants create colonies, city dwellers create neighborhoods, or simple pattern recognition software learns to recommend books. The evolution of simple to complex rules is called emergence (Johnson, 2001).

One of the characteristics of emerging systems and CAS is the ability to become more intelligent over time, responding to the changing and specific needs of their context. Another crucial aspect of Complex Adaptive Systems is the "Tags" or labels, which are the way to structure the aggregates. "Tagging is a mechanism that facilitates the creation of aggregates by allowing agents to distinguish themselves from one to another. Labels signal agents when interactions are possible, resulting in patterns of interactions that define boundaries between a collection of agents" (Boal & Schultz, 2007). The labels are the categories that structure an emergent system; later, this will be crucial to understanding how to convert a human system into an emergent one.

11.5.1 The Beginning of Emergence Design

In the mid-1990s, researchers went from analyzing the emergency to generating it. "Emergence philosophers struggled to interpret the world, and now they are beginning to change it" (Johnson, 2001). It was possible to build self-organized systems through software to recommend books, recognize voices, and recommend friends. Since their existence, organisms have lived under the laws of self-organization, but now emergent systems of consciousness are created, designed to take advantage of emergency laws (ibid.).

One of the fathers of Artificial Intelligence (AI), Oliver Selfridge, created a bottom-up, distributed, non-top-down intelligent learning system, a text recognition software. Instead of creating a single program, he made many programs (agents that he called demons). Each has the mission of detecting only one letter and voting the probabilities that they did so. Among the demons, they voted the likelihood of the letter they have seen being theirs so that another demon, with a selection function based on the votes, selects the one with the most significant probability of being and composes the text sequence (Selfridge, 1959). It is an emergent design with different agents at different levels; it is a unidirectional, still centralized design that flows from the bottom to up. It should also be noted that this scheme can lead to the loss of contextual information.

Considering the example of demons as a form of centralized organization because all the agents report to a higher agent who selects the agent's response with the highest probability. The agents do not know the likelihood of the other agents; the system is more efficient since it requires less information processing to accomplish the goal. A simple task (matching a letter of the alphabet) also does not require contextual information (the context of the demons is its letter; they don't need context). It is a balanced system, presenting efficiency and effectiveness. Nevertheless, the characteristics of emergent systems allow them to be organized in more complex ways according to the more complex context, this example is a bottom-up emergent behavior, but in more complex contexts, from bottom-to-bottom approximation should be more effective. The main limitation of the emergent system is that it will require more energy.

11.5.2 Emergent Systems Characteristics

Concerning the authors who make up the theoretical basis on emerging systems (section 11.5), the characteristics can be summarized in 5 points:

1) The emergence has an individualistic focus on the whole; the sum of individualisms generates the collective; it is a part of the explanation, although it can also mean that the whole affects the individual (recursive and hologrammatic principles). The study on emerging systems places local information as a relevant aspect for decision-making outside that locality (local feedback), from the micro to the macro. The agents that make up a system do not control the size of the system, but their experience and behavior change depending on how big the system is.
2) A more significant number of individuals is equivalent to greater probabilities of non-linearity of differentiation, and in diversity, there is a solution in complex contexts.
3) Emerging systems can become unmanageable when their elements are overly complicated. The premise is: that less complex elements create more complex elements (non-linearity?). Since the context in which an open system interacts is also open, it changes due to its transformation and feedback processes. As well as by the inputs and outputs resulting from other transformation processes and feedback from other systems. This process creates complexity (Fig. 12).
4) Causal exploration is also an element that fosters emergence. Emergent systems can be good explorers; these are good at seeking and finding. Exploration is the path to encompass the complexity and reassert control.
5) There are patterns of human habits defined as emerging, although the examples are from times of transition or due to the lack of governance structures that respond to the requirements.

The emerging systems, depending on their components and how they are arranged, can advance towards different objectives because they operate in dynamics of interdependence. They adapt to the context through them and are articulated through positive or negative feedback actions. The positive feedback actions activate or stimulate agents, generate changes, and cause destabilization or imbalance of the whole; the negative ones are controlling and counteracting. Emergent systems can develop more complex dynamics to embrace more complexity by means of stigmergy. It is inferred that the centralization process limits interdependence precisely for control; a single centralizing entity and the other entities connected to it equals interdependence = 0, or all entities connected equals interdependence = 1.

The fifth point of the analysis and this last inference indicates that, in the application of emergency in human systems, regardless of the more significant amount of energy required to sustain itself, the tendency to centralization and power dynamics will be its major brake. It cannot be defined and developed as an emergent system intended for interdependence 1 when the human power dynamic tends to interdependence 0.

11.5.3 The Emergence of Human Systems

When reference is made to explain emergence and ants are used, human society is not compared to ant colonies. Because in the world of ants, the queen does not direct the workers; none manages any. The first defines where the landfill is doing so through a receiving and emitting system of chemical elements that transmit information about its environment. This emergent system is processed by means of stigmergy (Gulyas et al., 2007). All of them are the same with different functions, perceive the same thing, and act in the same way; they do not need to agree because they have the same information and can infer the same conclusions. All are the same; they are all "the same ant." In this research, stigmergy is the conjunction of a physical technology based on a chemical receiver and emitter module and a social technology based on mechanisms activated by different chemical stimuli from these modules. Creating a form of self-management much more resistant and allows them to control any complexity in the ecosystem while maintaining the structure of the system controlled. Later, this will be crucial when designing the conversion from human to emergent systems.

Johnson, among others, set the city of Manchester as an example of a space with emergence characteristics, uses Engels' description of Manchester, a city that, paradoxically, being the one that promoted and initiated industrialization, was the last to form part of the English State (Johnson, 2001). It went from an estimated 24,000 people in 1773 to an official census of 70,000 people in 1801. In the mid-19th century, more than 250,000 people resided in the city. Considered a manor, technically governed as a feudal entity, with no local government, police, or urban planning structure, the city grew faster than its authorities could control (Ibid.).

According to the logic of argumentation’s research, it is evident that it could not be controlled; much more complexity was added for a feudal organization. It is a moment of transition where there is a dissonance between physical and social technologies. The social technologies typical of feudal society will not be able to respond to the new physical or social context; these could not explain reality. The reality of the new paradigms that technological tools generated, and the ways of thinking originated by these tools transformed everything. Engels, among others, traveled to Manchester to learn about the "future of the world," The reality was that all that progress or innovation that the city represented also had its decadence, inequality, and pauperism. Engels's systemic vision describes order and disorder, a form of an organization without government, with a highly differentiated social stratification by class and a series of patterns that emerge and are amplified in the city (city as an amplifier of patterns). Of course, a social system ruled mainly by money-market mechanisms collapsed.

The naturalistic orientation behind achieving balance and coordination in an emergent system requires that for this system to be successful, all nodes must be equal, have the same information, and have a predefined action for all nodes. Something that in humans is very complex to achieve and coordinate since the variables that define human thought and action are much more complicated (interests and power) than the automated systems referred to when discussing emergence.

Thomas K. McCraw refers to the fact that Mao Tse-Tung said: "destroy, that nature will take care of creating," misunderstanding Schumpeter's creative destruction and leading to pauperism throughout the country (McCraw, 2017) as if the only way to generate emergence was by broking pre-established structures. Greater destruction does not result in a more remarkable emergence; deliberate emergent processes can indeed be found in the human sphere, such as an Emerging Political Process (EPP), a process without any central node, through individual actions that create complex structures (Tarrow, 1994; McAdam et al., 2001; McAdam & Tarrow, 2018; Complexity Labs, 2022).

But the emergent process requires Stigmergy, distributed coordination without any single central structure. The "footprint" of an action in a context stimulates the performance of a subsequent action without the need for planning, control, or global communication. The action stimulates the next activity. "Where an action produces a mark which in turn incites an action, which produces another mark and so on" (Heylighen, 2016), creating a feedback loop (Parunak, 2006). "Stigmergy is an indirect, mediated mechanism of coordination between actions, in which the trace of an action left on a medium stimulates the performance of a subsequent action" (Heylighen, 2016). The same author compares the current form of social organization with this form; the researcher reflects that it would be very efficient if all the agents had the same rationality, interests, and information through a stigmergy process. The ants generate pheromones and leave traces that allow these chains of actions, a fundamental element for developing an emergent dynamic. Humans do not have this ability, but the researcher links stigmergy with CAS labels; in that case, labels act as stigmergy trails. And humans generate data, and this data can be classified as labels.

There is a considerable element of coordination in situations where social action emerges. If there are higher levels of interdependence, there are higher levels of coordination. The level of interdependence of a system is regulated by positive and negative feedback. Miller and Scott also define it: "Feedback alters the fundamentals of a system's dynamics. Changes are quickly absorbed in a system with negative feedback, and the system gains stability. With positive feedback, changes are amplified and lead to instability" (Miller & Scott, 2007). A balance between both feedbacks should describe a function f(x) of human and social projection, a model of progress where disruption and diversity result from positive feedback and where there is also regulation, control, and consensus from negative feedback. The ability of a society to generate wealth, its social capital, is based on its freedom to create, innovate, disrupt, and diverge, (positive feedback) to control and consensus (negative feedback).

In any case, emergence is closely connected to complexity (Marks, 2019). In addition, the fact that a society is increasing its interdependence generates a vector toward emergence and decentralization.

11.6 Approach to the Forms of Classical Governance

In the progression of technology and complexity that this dissertation describes, expressed in the forms of governance[38], it can be observed that the first version of democracy, classical democracy, was a very advanced form compared to the rest.
Fig. 13 shows the complexity of the organizational structure of Athenian democracy, a democracy that, in some cases, could be understood as direct. Although it was a short period, taken up again in modernity, it defines some point of origin to explain the current organizational situation.

The investigation begins with a bibliographical analysis of the construction of the Greek monarchy before the polis (Menéndez, 2003). The Constitution of the Athenians (Aristotle, 1984) shows the process of social organization, its operation, its complexity, and the problems it faces. This part of the analysis is complemented by The Republic of Plato (Plato, 1949) and with Politics (Aristotle, 1988), where the different forms of governance are described, the virtues and threats they represent, the separation of powers, how to improve the democracy, or how to design an ideal State. Polybius is also considered since he focuses on the Greek-Roman transition; he has a comparative perspective between Greek and Roman forms of governance (constitutions).

The bibliographical analysis is complemented by the second book of Economics (Pseudo-Aristotle, 1984), which differentiates various types of administrations and shows examples of the strategies of monarchs, governors of provinces, or commanders of troops to obtain money, just as the debt that was managed, the interest, and redistribution of resources. Likewise, to understand from complex (classical) to more complex (contemporary), the doctoral thesis of Ruy R. Gabarrón: Democracia y Datos, has been of great importance, which explains among others the conceptualization, design, and development of contemporary democracy (Gabarrón, 2016).

The argumentation begins by analyzing the genesis of the form of democratic organization and resource management; the abuse of power by the aristocracy is appreciated, something that Solon reformed, although he defined timocracy. The abuse of government power is indistinct from whether it comes from one monarch, aristocrats, or tyrants as if it comes from groups that make up oligarchies; it always ends in wars between rich and poor. Cleisthenes' reform focuses on isonomy, equality before the law. In addition, in the classic writings, the

[38] Governance is the organization of individuals.

democratic conception is based on the figures of the leaders, the number of bosses, and a centralized model of power, where the difference between the governance of the house and that of the city was by the number of leaders. A democracy that decentralizes power but continues to be orchestrated in centrality parameters.

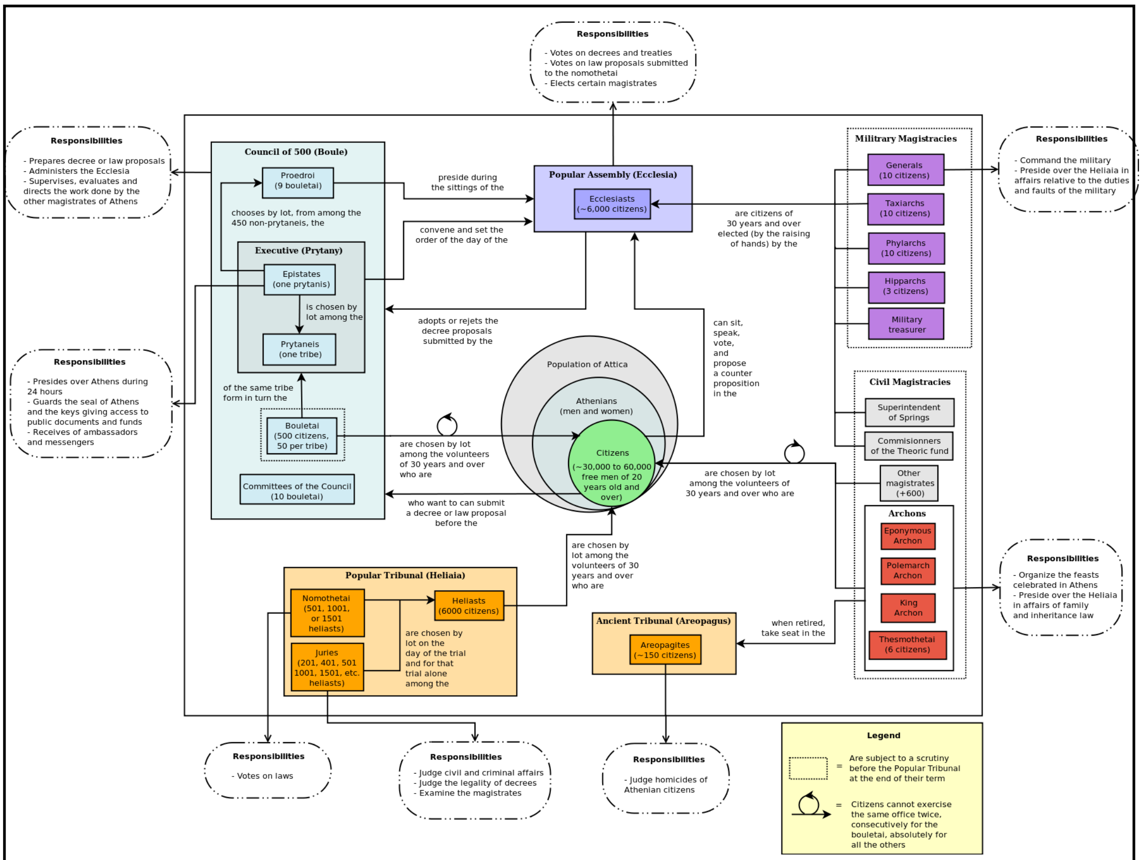

Figure 13. Scheme of the Athenian social organization. The eight states of responsibility are shown, divided into military, judicial, festive/social, and law/administration organization. It is a complex democratic scheme; it allows more complexity to be handled and presents elements of direct democracy. It requires a lot of energy (Source: Wikipedia).

The assignment criteria, functions and tasks, salaries, and obligations are observed in the division of powers. It is essential to observe the number of people necessary to manage this organization machine; in an Athenian society of approximately 30,000 and 60,000 free adult individuals, they need many people to manage energy and resources. Trials -or Councils- with juries of several hundred people that were centrally organized and probably with power dynamics often supported by magic and force.

Three regimes and their deviations can be distinguished from Aristotle: Monarchy (Tyranny), Aristocracy (Oligarchy), and Republic (Democracy); all are harmful, the latter being the least harmful (Aristotle, 1988). For Aristotle, governance should not be in the hands of everyone, only in the hands of those who know, not the ignorant, as well as in defining positions by lottery without defining the attributes of the lottery participants. Basically, these are the problems of representativeness; this not always represents good decisions.

It is widely understood that three deviations can occur within a democratic system: plutocracy, which is the tyranny of the wealthy, partitocracy, which is the tyranny of those in power; and ochlocracy, which is the tyranny of the uninformed. It is important to note that these deviations can coexist and are not mutually exclusive.

The last one, linked to ignorance, could be understood as populism and is the one that closes the anacyclosis according to Polybius (Polybius, 1923), where the sequence of mechanisms is configured cyclically between 1. Monarchy, 2. Tyranny, 3. Aristocracy, 4. Oligarchy, 5. Democracy, and finally, 6. Ochlocracy. Ignorance is related to the tyranny of the majority, the symptom of ochlocracy. Ochlocracy is also associated with corruption, as it allows for more self-serving action without proper control. Reach the point where powerful interests emerge for this purpose (ignorance), so society is ignorant and powerful people take advantage of this to govern. At this time, all that remains is to wait for a savior man, a true leader who will reopen the cycle with monarchies -or empires- (determinism). In *Histories book VI*, Polybius concludes that: "There being two agencies by which every kind of State is liable to decay, the one external and the other a growth of the State itself, we can lay down no fixed rule about the former, but the latter is a regular process" (Polybius, 1923).

The Athenian social organization (Fig. 13) illustrates, on the one hand, a primarily decentralized scheme of powers with an internal functioning of centralized powers, which minimizes but does not exempt power struggles. In other words, a decentralized scheme comprises a centralized scheme. It also denotes that it creates more complexity for the technological tools they had at their disposal and the amount of information they would need to process. It required a lot of people and energy (it was a slavery system).

The appearance of deviations from democracy (the edge of chaos) creates a complexity to which the system cannot respond. Society is organized to explain a physical and social context, a sense, not for something that has a meaningless explanation. An aspect that, together with the wars with Sparta (the demographic structure is a variable that defines energy), causes the system to lose internal energy for its operation, and that organizational system cannot be sustained. Monarchies require less energy, which makes them more efficient.

11.7 Approach to Contemporary Forms of Government

Christopher Turnbull in Design Concepts for Governance Architects (Turnbull, 2010) differentiates six types of organization based on a) Markets, b) States, c) Communities, d) Networks, e) Associations, and f) private hierarchies. These forms depend on "the ability of humans to communicate with each other to coordinate their actions. The starting point for applying governance science to human society must be based on the ability of humans to receive, store, process, retrieve, and transmit data" (Ibid.). Turnbull comes to the same conclusion as previously researched; society will be according to its interdependencies.

Koestler, coined the term "holon" to define the subsystems or the different nodes that make up a set (Koestler, 1967) and describes the holacracy as a hierarchy of holons, where the groups, hierarchically, create the complex whole (Rodriguez et al., 2007). Holons are self-organized assemblies and, based on what has been exposed in the emergence and complexity section, it is inferred that they resemble a more horizontal, bottom-up hierarchical structure, with emergence characteristics, as the Rodriguez team shows (Ibid.). Fostering greater freedoms of the components, as well as agility, transparency, and efficiency (James, 2012).

It can be seen in holacracy.org that holacracy creates an organizational methodology, fostering creativity and innovation. Mathews (Mathews, 1996) states that the advantage offered by these organizational models over the strictly hierarchical ones is how they deal with (a) centralization and decentralization of control, (b) systemic reliability, reliability as a whole, (c) the flexibility offered by the set, (d) the most remarkable response capacity of the set, (e) the greatest learning capacity of the set and (f) organization innovation (Mathews, 1996; Turnbull, 2010).

To the researcher, this indicates that the "natural" explanation for human organizations to adapt to complexity through a hierarchical structure could be biased by a hierarchical context, a way of thinking where hierarchy is the rational way to manage society. The best way to organize individuals is not only hierarchical; it will depend on the complexity of the contexts and the ability to process information (energy) through the transformation and feedback processes of the system. "Interaction, interdependency, autonomy and dependency properties compose the property of organization" (Kaspary, 2014).

At this point in the investigation, the Mondragón Corporación Cooperativa organization appears on several occasions as an example of holacracy with a network structure, and with a cooperative action, in such a way that they respond to the recursiveness through positive feedback, creating schools, social funds, and social promotion actions for the individuals that compose it. Rodriguez team describes the capabilities of a holon structure (Rodriguez et al., 2007):

- "Atomic. The capacity is already present in one of the members of the super-holon. In this case, the head has to simply request the member possessing the required capacity to perform it.
- Liaised. The capacity is obtained from a subset of the member's capacities following a known protocol.
- Emergent. The capacity is not present as an atomic capacity nor it can be obtained as composition of them. The capacity emerges from the interactions of the members."

Turnbull refers to the principle of Schumacher's subsidiary function: "It is an injustice and at the same time a serious evil and a disturbance of the correct order to assign to a higher order and a superior association what smaller and subordinate organizations can do" (Schumacher, 1975). Turnbull also states: "The Subsidiarity Principle also enriches democracy by increasing the participation of those most affected by decisions to become more conditionally involved in appointing decision makers" (Turnbull, 2010). The implications of this principle are essential since the definition of social action is reversed from below and not from above, bottom-up.

A society formed by almost autonomous subsets -or holons- are "stable intermediate forms" (Simon, 1962). In such a way that, in this context, there would be no lack of a superior element that comprises the entire set since the set as the whole is implicit in the holons. It also stands out from his work that two of the most costly and essential roles of government are: (a) the redistribution of wealth (energy) through taxes, social services, and payments, and (b) protecting consumers, workers, investors, interests of third parties and citizens (Turnbull, 2010).

Turnbull defines a guide for self-governance (Ibid.):

"(i) A division of powers with checks and balances for self-governance.

(ii) Eliminate, minimize and/or creditably manage conflicts of interests of board members.

(iii) Stakeholder engagement in a manner that enhances, rather than jeopardizes the operations and sustainability of the organization.

(iv) The decomposition of decision-making labor to within acceptable operating capabilities of individuals.

(v) A basis for individuals to constructively behave in a contrary manner to act as a loyal opposition and provide governance tensegrity.

(vi) A requisite variety of feedback and feed forward data independently of management to monitor and control mangers on a reliable basis:

(a) Integrate management into governance and governance into management.

(b) Allow all members of organizations to participate in its governance.

(c) Enrich democracy with the facility for all concerned citizens to engage in the governance of the organization.

(d) Allow stakeholders to protect and further their interests with the common good,

(e) Minimize the size, cost and intrusiveness of government, laws, regulations and Regulators.

(f) Integrate social and environmental responsibility and accountability into the governance of organizations.

(g) Improve the political and social legitimacy of firms and other organizations."

This dissertation also considers the work of Laloux on analyzing organizations in the current context; the author defines TEAL organizations as the future of organizations. Organizations focus on bringing out collective intelligence, social capital, and self-organization, so there are no hierarchies, and decisions are made decentralized (Laloux, 2014).

As previously observed, there is a path in the forms of social organization, the current situation is not the final state; it follows a trajectory and process of change. A social organization is a technology that has a past and future trajectory. The recursion between physical and social technologies indicates that social organization and material technology have gone hand in hand. So, the better[39] the physical (or social) technology, the better the social (or physical) technology. A better social organization equates to better capacities to achieve physical achievements, and better physical achievements equate to a better social organization.

The current form of organization, through transformation and feedback processes, responds to specific contexts and configures a centralized and hierarchical scheme; It does not mean that if the contexts change/acquire complexity, the transformation and feedback processes based on centrality and hierarchy should not change. If the context changes, it generates resistance to the system that must regulate through the transformation and feedback processes.

11.8 Introduction to Spheres of Complexity

From the individualistic perspective, the sum of individuals configures society; from the holistic perspective, society configures the sum of individuals. From the standpoint that the investigation takes, it is not only the sum of the two perspectives but also the recursive and hologrammatic principles between individuals and society. In any case, the effect is a cause, as stated by the recursion principle, that generates complexity. The historical analysis in the previous sections also analyzes the change in complexity, a sum of complexities that give more significant complexities. It is also appreciated that the ways of organizing can fall when they are ineffective in the face of a new level of complexity, a change in the context, and the reflection begin to appear that, according to the definition of technology, managing complexity is managing progress by managing more context. The increased complexity observed throughout the work creates new agents, and waves of social democratization, empowerment, and social emancipation are produced. As has also been seen, interdependence is the characteristic element in this change process that grants the capacity for self-organization, resilience, diversity, and progress. The feedback of this interdependence determines this capacity. In this section, the research needs to find out ways to understand and organize complex systems, (complex endogenous and exogenous contexts).

11.8.1 Social Complexity

There is no standard definition of complexity in the scientific field (Paradisi et al., 2015); the term has a different meaning depending on the discipline. In general terms, Wikipedia defines: "A

[39] Better response to systems that fit the context. That grants greater social empowerment and efficiency; see the technological section.

complex system is composed of several interconnected or interlocking parts whose links create additional information not visible to the observer as a result of interactions between elements." However, there is evidence of social and political complexity progression throughout human history (Johnson & Earle, 2000). The researcher considers as an introduction to the complex social approach, the writings of Herbert Simon, and bounded rationality from March, which shows a way of understanding complexity from a hierarchical explanation (Simon, 1962; March & Simon, 2005). It is extracted that managing social relationships involves greater brain capacity and more significant information processing. Robin Dunbar estimated 148 social connections an individual can control (Dunbar, 1992), others estimate far fewer, and others argue many more (Lindenfors, 2021).

This analysis, after reflection from the previous sections, interprets that physical and social technologies define new limits of interdependence and progress and that it seems that the capacity to process information -or the number of social relationships- is also limited by the human being. But this limit changes, the researcher speculates that not all social relationships behave the same size of information, nor the same intensity of communication. Also, each cognitive system is different; some people manage ten or even fewer direct social relationships at the end of their life. And technology can multiply this number ¿how many connections does an Inuit family have throughout their life? And without the internet? Even so, 148, as the maximum number of connections, still represents a small social environment, such as a town or a village. A town presents a different complexity than a city. As seen in the technology section, these add complexity to the contexts, and social technologies improve the organization's management to control the physical and social contexts. Taylor already said in his book *The Principles of Scientific Organization* that "in the past, the individual has come first, but in the future, the system will come first" (Taylor, 1911).

Taylorism methodologically standardizes a social organization of thousands of people scientifically for a common goal, such as creating a car. There is always talk of the common objective of the agents that make up an organization (like the example of Ford) to produce a product (like the Model T). It cannot be inferred that the workers had the same goal as Mr. Ford, he probably had the purpose of creating a more popular car, but the goals of most of the other members of the organization were outside the sphere of goals of the organization -like probably ones feeding their families, and others trying to get more money from their investment-. An institution like Ford makes it possible to combine various non-common -or individual- objectives, which are outside the sphere of the organization, and transform them into something in common, a car, which allows the achievement of non-common objectives through capital.

This is a very different and more complex description to that of the old forms of social organization, the irruption of capital as technology is appreciated, it becomes accessible and has a much more important role; a technology that allows us to cover greater complexity area, and the workers can be the consumers of the cars which add more complexity, being consumer and worker add interdependencies because add systems.

Throughout history, this recursive relationship between physical and social technologies has led to modernity being characterized by the explosion of organizations and institutions. People have never organized in so many different or complex ways, regardless of whether through cooperatives, companies, political groups, unions, pressure groups, or other ideologies; it is unthinkable for someone from the X century to organize in so many ways. It is an explosion of interdependence, feedback, possibilities, and progress. It must also be remembered that institutional forms changed definitively the conception of individuals about themselves, the world in which they live, and the context they create. Before, very few institutions defined the conception of the world, and now there are many.

Social complexity can also be seen in the datasets of the Social Complexity section of the Seshat project (Turchin et al., 2015), in which it is evident how the forms of social organization change as contexts become more complex (Turchin & Gavrilets, 2009). It is not the same to make decisions one than several, or some that have correct information and others that do not; many factors indicate the success of the decision, but the element that validates success or not, will be the complexity of the contexts that individuals live and of course, the ability to adapt to that context (capacity to organize the characteristics of the individuals to solve a problem). There is also evidence of how complexity is added to the context through factors internal to society (technology, organization, demography) or ecological (climatic, geographic, resources) (Hamilton et al., 2020).

The same analyses suggest that the most significant component of social complexity is a measure made up of institutions and technologies that allow the coordination of many people to act in a common way (Turchin et al., 2018). When the work focuses on the different stages of social complexity, or the social context to respond to the physical context, it is found that sociopolitical development is dominated first by a) growth in the political scale, then by b) the improvements in information processing and economic systems, and finally by c) further increases in scales (Shin et al., 2020); and that they are aspects that have been appearing along the entire investigation.

If previously it has been stated that interdependence relationships allow higher levels of progress and complexity, it can be affirmed that there is a relationship between heterogeneity or diversity and complexity. Diversity entails more significant information processing and a greater field to control, not only at a social level but also at a neuronal level (Patriarca et al., 2015). Also, because the information is the opposite of uncertainty, according to Miller, information refers to the number of formal patterns or complexity in a system (Miller, 1965). This means that as more information is acquired, the level of uncertainty also increases.

Although there has been a scientific discussion about the relationship between demography and complexity, some correlate demography with sociopolitical complexity

(Feinman, 2013). Others say the archaeological evidence does not confirm this correlation (Vaesen et al., 2016). Finally, it can be stated that although more complex societies tend to have larger and denser populations, more extensive and denser populations are not even more complex (Hamilton et al., 2020). The complexity does not only come from a demographic vector; this is only one part of the equation. There are tiny populations that must be organized with enormous complexities. However, the more demographic populations, the multiple diversities can arise, and this adds complexity.

11.8.2 Approach to Complex Systems

Reference is made to studying complex systems through complex thinking (Tsoukas & Hatch, 2001). "Echoing the theory of mathematical information (Hayles, 1990; Shannon & Weaver, 1949; Casti, 1994) defines complexity as "directly proportional to the length of the shortest possible description of [a system]" (Tsoukas & Hatch, 2001). Its main characteristics are extracted from the same article:

1. "Complex systems are non-linear: no proportionality exists between causes and effects. Small causes may give rise to large effects. Non-linearity is the rule, and linearity is the exception.
2. Complex systems are fractal: irregular forms are scale-dependent. There is no single measurement that will give a true answer; it depends on the measuring device. For example, to the question "How long is the coastline of Britain?" there is no single answer, for it hinges on the scale chosen to measure it. The smaller the scale, the larger the measurement obtained.
3. Complex systems exhibit recursive symmetries between scale levels: they tend to repeat a basic structure at several levels. For example, turbulent flow can be modeled as small swirls nested within swirls, nested, in turn, within yet larger swirls.
4. Complex systems are sensitive to initial conditions; even infinitesimal perturbations can send a system off in a wildly different direction.
5. Complex systems are replete with feedback loops. Systemic behavior is the emergent outcome of multiple chains of interaction. As the level of organization increases, complex systems have the tendency to shift to a new mode of behavior, the description of which is not reducible to the previous description of the system's behavior. These emergent novelties represent points of bifurcation" (Ibid.).

In Tsoukas & Hatch's work, the distinction between two dimensions or two orders of complexity is observed, the first as described up to now (logical-scientific), the second "the domain of the thinker thinking about complexity," and achieved through propositional narrative, interpretation of context, reflexivity, and subjectivity. According to this distinction, organizational complexity is in this second order of complexity.

Darin McNabb subsequently summarizes nine characteristics of complex systems (McNabb, 2017):

1. Complex systems are composed of many elements and multiple parts. If there are few elements, it is a complicated system, and a mechanic of cause and effect occurs. Complex systems comprise many more elements, and the process of cause and effect are no longer linear.
2. The relationships between the parts are dynamic; there are changes, but there are not always the same.
3. The parts are interdependent.
4. The relationship between cause and effect is not linear or proportional. Small causes can have considerable effects. Complex models are non-linear models.
5. It consists of recursive interactions, which can be positive or negative feedback.
6. Complex systems are open to the context, and complicated ones are closed.
7. Complex systems are not in balance.
8. Complex systems change over time.
9. The parts act with local information; these are unaware of the behavior of the whole.

The work of Remington and his team defines nine factors to analyze complex social systems: 1) Difficulty. 2) Non-linearity. 3) Uncertainty. 4) Uniqueness. 5) Communication. 6) Context dependency. 7) Clarity. 8) Trust. 9) Capacity. As well as five dimensions: A) Goals. B) Means to achieve goals. C) Number and interdependence of the elements. D) Timescale of the project. E) Environment (market/political/regulatory) (Remington et al., 2009).

Furthermore, as previously stated, societies are thermodynamic systems subject to the laws of physics (Gill et al., 2007). Ilya Prigogine explains that self-organized systems with hierarchical structures require a stable and robust energy source to organize themselves (Prigogine, 1980). If the energetic flow is broken, it collapses to the point where the hierarchy can be sustained with sufficient energy. The second law of thermodynamics states that systems tend to entropy to the loss of energy. Miller, among others, affirms that the loss of information is entropy (Miller, 1965), and information is energy (Shannon, 1959). Something that is also found in (Turnbull 2010) since the data involves changes in the state of matter, which is equivalent to energy transformation.

Atlan's principle of order from noise is central to the understanding of self-organization (Mark, 2019). "Disorder can be defined as any phenomenon that cannot be predicted deterministically or mechanically, and noise refers to any perturbation that interferes with the transmission of information" (Morin, 1973; Mark 2019). To understand the relationship between noise and self-organization, one must deepen more, citing a Mark literally: "Shannon defines information as a particular arrangement of elements that is distinct from all other possible arrangements, and that can be transmitted as a sequence. The transmission process can be disrupted by random perturbations (e.g.) noise. Redundancy, in the shape of repeated elements, can help to protect the fidelity of the transmission against the disruptive effects of noise, although redundancy of this kind necessarily entails a cost. The main problem with Shannon's formulation, according to Atlan, is that it neglects the issues of meaning and the creation of new information" (Ibid.) And follows: "For Shannon, whose primary focus was the preservation of the message, noise is destructive, and redundancy is a cost that is paid in order to protect against noise. From the perspective of self-organization, however, noise actually creates new information, and a certain amount of redundancy is required to facilitate change" (Ibid). And quotes: "Redundancy for communication engineers is a burden. It is a bonus for biologists" (Atlan and Cohen, 1998). Atlan explains this principle in Entre le cristal et la fumée by means of a "simple model of a system S comprising two subsystems, A and B. As far as the overall quantity of information in the system is concerned, the optimum level of operation for the system as a whole entails a degree of transmission between A and B, but also a certain number of errors" (Atlan, 1979). The positive effects of noise are maximized in a highly complicated system with multiple direct and indirect connections between subsystems" (Mark, 2019).

The analysis of complexity that Lansing carries out from a humanist perspective (Lansig, 2003) is quite important in contributing to this work. It introduces the concept of "the edge of chaos" in the dissertation, which is studied in the book *Complex Adaptive Systems, an introduction to computational models of social life* (Miller & Scott, 2007). At this time, research relates this threshold between complexity and chaos with the moments of the downfall of societies or the dissonances between social and physical technologies. It is the relationship between the complexity created and the complexity that it can assume; if the complexity created is greater than the complexity it can handle, chaos tends (Manchester City). The researcher deduces that the limit between complexity and chaos is mobile. At that threshold, social or physical technology cannot overcome complexity; above that threshold, complexity becomes chaos. Its sphere of complexity does not allow it to cover beyond.

Lansing also points out, as May did before (May, 1976), that non-linear effects tend towards chaos (Lansing, 2003). Herbert Simon states: "The evolution of complex systems from simple elements does not imply anything, one way or the other, about the change in entropy of the whole system. If the process absorbs free energy, the complex system will have a lower entropy than the elements; if it releases free energy, it will be the opposite." (Simon, 1962; Lansing, 2003). The analysis interprets that a hierarchical system can be inefficient but effective if it has a stable and abundant energy source; when the energy flow falls, it is inefficient and ineffective. The analysis interpreted systems as sets that process energy and tend to entropy, and living sets can organize this energy. How they manage that energy means that the system can respond to complexity in one way or another.

11.8.3 Complexity Control

There are various ways to organize this energy, first, Bertalanffy and Weiss consolidate hierarchies between systems and subsystems (Weiss, 1971), then Herbert Simon concluded that hierarchy is a characteristic of complex systems and related it to formal institutions (Simon, 1962). Zylstra (Zylstra, 1992) mentions the hierarchical authority and ecological hierarchy. Eldredge and Zylstra refer to aggregate hierarchies, a scheme in which elements are added to build superior sets (Eldredge, 1985); as previously seen, it is the creation of centralized forms from subsets upwards. These forms or models are based on creating large-scale systems from smaller units through a way of "upward causation," as seen in holons, hierarchical control systems base control on the limitation or freedom of the sublevels (Zylstra, 1992). And that these limitations or constraints (Müller, 1992) act through a form of "downward causation" (macro to micro effect) (Campbell, 1974).

It is easier to divide an extensive system into subsystems and so on. This requires specialization; if there is specialization, there is less probability of error and greater predictability of the action. This entails that the node is only responsible for its task or for an area of the context to control and does not require information from the objectives of the superior system. In addition, since the nodes will experience errors, hierarchical systems have some capacity for failure; if one node fails, the rest of the system can continue to operate. Although the rest of the nodes or subsystems that depend on the one that fails will be affected, they will also fail; if the node of a high hierarchy fails, all the nodes that rely on that hierarchy will fail. Perrow, Simon & March or Staw are benchmarks for detecting centralized institutions' negative externalities, Bounded Rationality, dysfunctions, and limitations (Perrow, 1972; March & Simon, 1993; Staw, 1997), as Nieto, who shows how errors are created in complex bureaucracies (Nieto, 1996) and absorbed by the rest of the hierarchy. The researcher understands that if there is greater interdependence between different nodes, the exposure of the error would be minimized. There are greater chances of reducing the probability of error among all the nodes than just in one.

In the natural world, whether it refers to a set of molecules, an organism, or a society, a hierarchy can be defined between these three elements in a magnitude order. Each element comprises the other, and no one is more important than the other. For instance, a human being is not more "important" than the cells it is composed of because the human being is composed of cells. Similarly, society is not more "important" than the individuals it comprises because society is composed of individuals. Both are sets of systems that conform to more complex systems, and the systems define relationships between them.

It cannot be assumed that, since hegemonic societies are complex and hierarchical, the best way to manage complexity is hierarchical since, in the analysis of the emerging systems, it is observed that both biological and computerized organisms handle much more complexity comparatively without being hierarchical structure[40]. This aspect is essential, as will be seen below. Hence the ways of encompassing greater complexity can originate forms of complex centralized structures; yes, as Simon -and others- say, because they consider the dimension of power, power acts as a hinge element, it controls -and delimits- interdependence, and manage complexity requires lots of interdependence. But it cannot be said that it is the only way to encompass complexity because, in more complex environments, power hinders progress; it limits it.

It is observed throughout the investigation that complexity is a continuum; it is always from complex to more complex, and new levels of complexity are assimilated. And yes, to reach a given level of complexity, a centralized organizational complexity scheme may be more effective, but it also cannot be inferred that, if complexity increases, this centralized form of control is the most effective way to manage it. Anderson & McShea show that complex societies in a complex environment are best managed decentralized (Anderson & McShea, 2001). The argument takes ants as an example; it shows that their interdependence level is very high, ants are all the same and act as one with a stigmergy process. As seen, that is why they can function in an emergent and synchronous way, defining a system that is highly resistant to complexity, something very different in the human being and the societies that are formed due to the dynamics of power, and because individuals are different, have other information, different rationalities, and irrationalities, different cognitive schemes, and they do not act the same.

Lawrence and Lorsch define differentiation as "the state of segmentation of the organizational systems into subsystems, each of which tends to develop particular attributes in relation to the requirements posed by it relevant external environment." And integration as "the process of achieving unity of effort among the various subsystems in the accomplishment of the organization's task." (Lawrence & Lorsch, 1967). They found that highly differentiated centralized subsystems have more difficulty in integration. Regarding William Richard Scott's statement on Contingency Theory, "The best way to organize depends on the nature of the environment to which the organization must relate" (Scott & Davis, 2000), which suggests that there is no one best way to organize an institution, as the optimal structure depends on various internal and external factors. Scott argues that institutions must adapt their structure to fit the needs of their environment, and that the most successful institutions are those that can effectively match their structure to the demands of their environment. The research infers that, depending on the level of complexity or its sphere of complexity, there is an optimal form of organization to respond to that complexity.

[40] The human being as a biological organism is probably composed of emergent and decentralized systems that shape what it is, a human being.

In Fig. 14, four forms of organization are illustrated, and depending on the form, it requires more or less energy to organize, or it may assume greater levels of complexity. The most complex form (Type IV) requires coordination, cooperation, and processing much more information and energy. Compared to a gathering organization, organizing to hunt requires cooperation and a high level of interdependence, so the energy cost of the organization is much higher. There is no better or worse organization; there is a type of effective organization according to the complexity of the context.

Complexity Level	*	**	***	****
Level of Information	*	**	***	****
Level of Interdependency	*	**	***	****
Energy Level	*	**	***	****

Figure 14. Different schemes to organize complexity, from the less complex (type I) on the left, to the most complex (type IV) on the right. Not only is efficiency important, but also effectiveness. It is useless to be efficient if it cannot be effective.

In other words, using a (Type IV) scheme for low complexity, even if it is very effective, requires too much energy, and will not be efficient, the optimal structure to cover that complexity would be a (Type I) or (Type II). Just as trying to use a (Type I) form to hunt will not be effective, the optimal structure to encompass the complexity of hunting will be a form (Type III, Type IV), albeit with a higher energy requirement. The higher the level of interdependence, the higher the level of energy. At the same time, one can also appreciate a form with a more centralized, hierarchical tendency (Type I, Type II) and a more decentralized structure (Type III, Type IV). There is no dichotomy between centralization and decentralization, it is a degree.

As previously stated, the research considers that a system is made up of multiple subsystems, and at the same time, these are made up of other systems and subsystems. Also, the organization is in the realm of living systems and not in that of inert ones (open system versus closed system). In this organization of the living, functions, and processes, hierarchies and mechanisms are created; that configure a more or less limited interdependence according to the level of the centrality of power (information and energy).

11.8.4 Centralized and Decentralized Complexity Spheres

More complex societies are not better than less complex societies; there is no normative, and complexity is a non-normative phenomenon (Turchin et al., 2018). But if a complexity degree is observed, and that follows a trend from a hierarchically centralized form to a hierarchically decentralized form. The difference between one form and the other lies in the spheres of complexity that can be handled by one and the other through 1) the efficacy achieved in addressing external complexity, being an exogenous factor; and 2) the efficiency of the complex organization process itself, being an endogenous factor. And this is achieved through an interdependence process and with positive or negative feedback. The analysis determines that these are the two indicators that define the adequacy of a scheme to complexity.

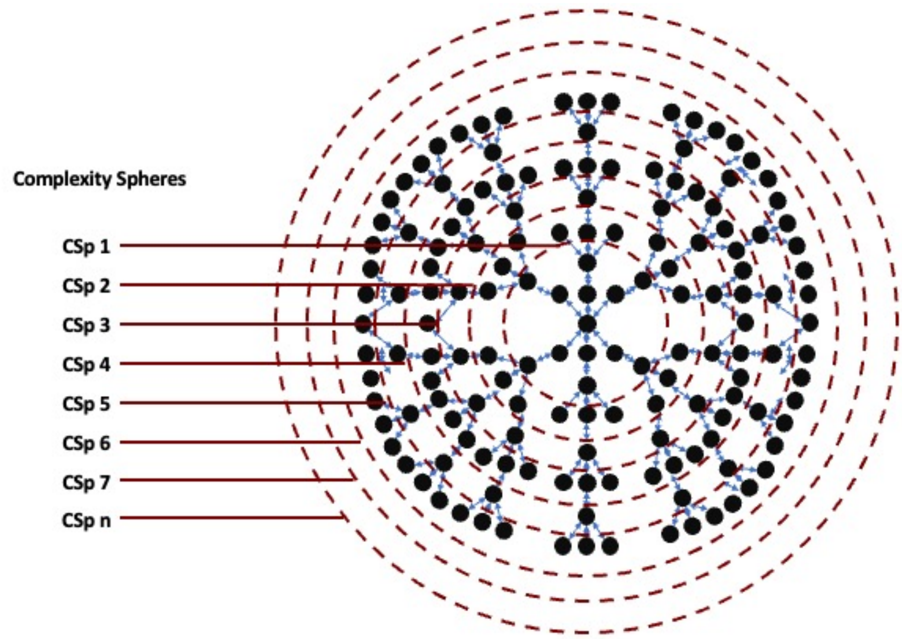

Figure 15. The scheme relates the form of centralized organization to manage complexity. Complexity spheres in 2D are shown as context, endogenous (social), and exogenous (physical).

In Fig. 15, the framework represents the context to be controlled, the totality where there is uncertainty, unknown, and complexity. It also illustrates that, in a larger context, there is a greater complexity sphere (CSp_n), and a centralized model is observed to control that complexity. This structure covers bigger volumes of spheres of complexity. This type of structure is observed through the work of Alfred Chandler carried out by Palmer's team (Palmer et al., 1987), which shows a form with multi-division behavior (MDF). It is a centralized model, which grows through division and specialization and assumes newer complexity spheres as it covers a greater contextual field. This specialization comes because the nodes are different; the specialization corrects this difference. Specialization is then understood as reliable and predictable for the task it must perform. It is what Norbert Wiener defines as conduct rigidity (Wiener, 1958); if all nodes have the same behavior, the system works correctly, and if the same behavior does not exist, it generates errors. The way to avoid mistakes is to standardize through specialization; specialization is standardization and raises predictability.

The hierarchical system shown in Fig. 15 has a lesser interdependence by default, defined by the nodes or subsystems immediately to its position. At the moment in which the complexity of the context is too great, the redundancy of division and specialization to which it is arriving loses effectiveness; as new spheres of complexity are covered, the structure will be less effective because of loss of efficiency. The Law of Requisite Variety or Ashby's Law state, "for a system to be stable, the number of states that its control mechanism is capable of attaining (its variety) must be greater than or equal to the number of states in the system being controlled" (Ashby, 1956). Turnbull summarizes Ashby's Law as "only variety can destroy variety" (Turnbull, 2010). The structure must be equal or over-dimensioned according to new varieties. More variety equals more structure to control it, and less variety equals less structure to control it. Turnbull relates this law to the impossibility of controlling many variables without creating controllers or regulators. At the same time, he argues that the signal (referring to the connections between nodes) is distorted, and data is lost across these intermediaries (Ibid).

This is why the centralized form of organization no longer adjusts to the complexity that must be resolved in states where the variety or heterogeneity is more considerable, reaching a point where the structure itself becomes an obstacle to continue covering new spheres of complexity, and the levels of entropy arise (the edge of chaos). In other words, endogenous factors do not allow for more complexity to be covered. In such a way, centralized organizations, which revolve around a node, can be efficient and effective in complex contexts. However, as these organizations cover greater spheres of complexity and the form grows, endogenous factors limit the ability to the effectiveness of the whole (CSp_n). As a centralized system grows, the endogenous complexity is so great that it cannot handle the exogenous complexity.

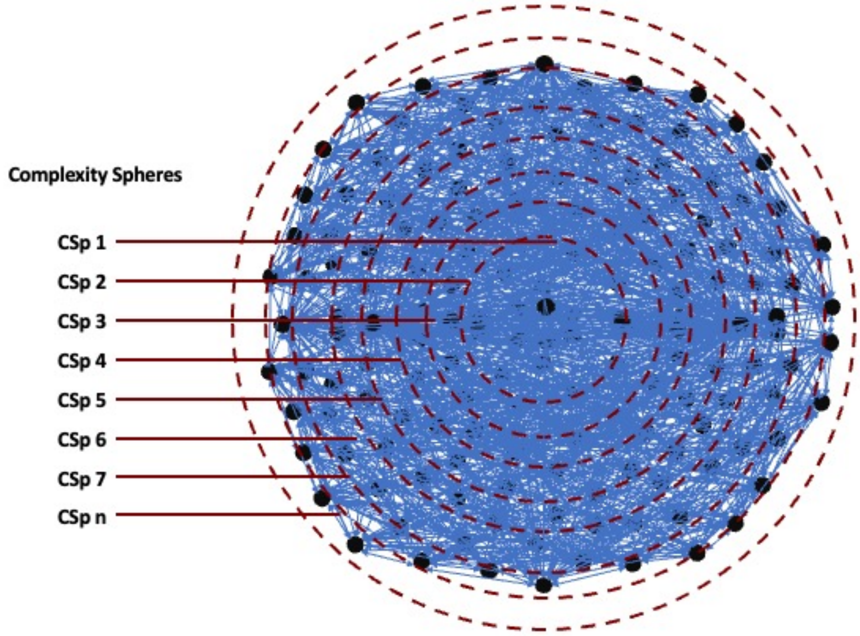

Figure 16. The scheme relates the form of decentralized organization to manage complexity. This is a full interdependence scheme as an emergent system. The same agents can cover more complexity spheres.

In Fig. 16, the structure of an emergent, self-organized system is shown, a decentralized form showing full interdependence; the structure that conforms is more complex and also encompasses greater context complexity spheres (CSp_n) with the same number of nodes as in Fig. 15. It would also be a CAS model. Basically, this form has two characteristics that are limiting:

I. The amount of energy the system requires increases as it covers larger spheres of complexity. Following the examples of ants or slime mold, if each node of that emerging system had a data processing capacity equal to that of a human being, the amount of energy required to sustain that biological organism would be so tremendous that it would probably be difficult to exist on earth.
II. An emerging decentralized system consists of nodes with equal processing capacity and agency in a stigmergy process. While this system offers equal freedom to all agents, it also results in a loss of individual identity. Moreover, the predictability of action becomes crucial in handling complex contexts.

It is also interesting to analyze the article The Dangers of Decentralization by the World Bank Research Observer (Prudhomme, 1995). Where Prudhomme speculates on decentralization, his observations and conclusions are the basis for the research reflections:

- Decentralization can threaten stability. The researcher understands that it is true, from the perspective of power developed in the investigation, that decentralization threatens centralized hegemonic stability.
- Decentralization allows greater disparity and diversity, decentralization promotes diversity and disparity and conflict arises when no consensus exists between the parties that represent them (human systems are not emergent, and there is no "natural" regulation

based on stigmergy). It is then inferred that, in a centralized structure like the current one, regulation controls disparity and diversity through the centralization of interdependence (State); it is the control of interdependencies and monopolies that have been seen previously, but from a different perspective. The researcher understands that this way is not the only way to control disparity and diversity, the logic that follows this dissertation understands that there are technologies that allow controlling diversity, disparity (positive feedback) and consensus (negative feedback) to define new ways to encompass greater complexity, there are alternative paths. Delving into a model of human stigmergy may be an alternative.

- Decentralization makes it challenging to implement macroeconomic policies and ignores geography. The researcher reflects that, at this point, Prudhomme did not consider current technology. Many years have passed since 1995; the networked society is a little bit more of a reality. Although a decentralized model may have a low interconnection, applying a policy (information) from node A to another node N should go through many nodes, information and energy are lost along the way. Currently, network technology allows a very high interconnection globally between individuals, p2p, and encompasses the entire geography and casuistry. It is true that, although there is a lot of information about what happens in any geographical location, the information is partial. It is not the same to see a war on YouTube as to listen to the bombs fall; physical location is important.
- Decentralization tends to tax perversion. The researcher considers current taxation based on centralization and redistribution, and there is no decentralized regulation. The researcher infers that in a decentralized structure, all must legitimize an emerging and decentralized regulation; all the nodes control and regulate the organization, and these are responsible for it, but it is not based on a central node that redistributes (as current fiscality). The researcher understands that regulation and decentralization are different elements, not opposite concepts; one is structure, and the other is the process. Centralized structured regulation cannot be applied to decentralized structure regulation, as seen before, all systems require regulation; a decentralized regulation must be created.
- Decentralization is inefficient since what can be done centrally is redundant locally. The researcher interprets that it is true in simple ecosystems, but this efficiency becomes ineffective in complex contexts and does not allow for greater complexity to be covered.
- Decentralization is not electoral; the researcher understands that the author is correct; the decentralized model does not adjust to the electoral parameters of a centralized model. Representativeness is an essential element of democracy; where one does not arrive, the other comes, groups a concern, and this representativeness is centralized as an efficient way of combining energy or information. The centralized electoral form was a considerable advance and is part of social technology. And current technology should

make it possible to improve representativeness without going through a uniting entity. Creating a new understanding of representativeness would be an advance for democracy; it would be an assembly. In an emerging model, such representativeness does not exist because all the nodes are equal, infer the same information, reach the same conclusions, and, therefore, the same action. This could be the main criticism to the decentralization structure since human beings are not equal to achieve this.

- Decentralization can lead to more corruption, although this, according to Prudhomme, would be more distributed. Prudhomme interprets that there will be more corruption at the local level because there is not as much political interconnection -control- as at the national level; he then infers that there is less corruption at the national level than at the local level. Corruption indeed requires cooperation, but that does not mean that cooperative societies are more corrupt or more sensitive to corruption. Corruption follows a power dynamic, and as this thesis defends, the way to control power is by decentralizing it. The fact that the State is divided into three independent powers (legislative, judicial, and executive) is evidence of such support.

11.8.5 Brokerage

It must also be pointed out that what Charles Tilly describes as a brokerage is a node that links and unites two nodes, it is also an element of efficiency since it allows this relationship; it is the intermediary. This element is essential to understand the interrelationship of a centralized system and is subject to power dynamics through control of interdependence. But as has been seen, at the moment of covering larger spheres of complexity, these are not effective, the efficiency that allows limiting the information, and the interdependence, makes the whole lose effectiveness. In a decentralized system, a brokerage is not required, no hinge elements and the relationships are direct.

In the analysis of the transformation mechanisms carried out by the McAdam team, the following stand out: "Brokerage is the linking of two or more currently unconnected social sites by a unit that mediates their relations with each other and/or with yet another site. In the simplest version, sites and units are single persons, but brokerage also operates with cliques, organization, places and, at the limit, programs" (McAdam, 2001). The researcher also infers that the intermediation process is not only a connector between agents but also a creator of agents.

11.9 Reflection

In his book Cybernetics and Society, Norbert Wiener already points out that "the machine and the living organism are devices that locally and temporarily seem to resist the general tendency of increasing entropy. Through their ability to make decisions, they can produce around them a local zone of organization in a world whose general trend is the opposite" (Wiener, 1948).

Although the sources are over 50 years old, there express a timeless contextual reality; the machines control the ecosystems and provide security, according to the definition of technology made at the beginning of this research.

At this point of reflection, it is also observed that entropy is the element with which complexity is faced, the greater the volume of the sphere of complexity, the greater the tendency to entropy. Miller's note on negentropy, or inverse entropy, is critical, where the system exports its entropy to maintain its levels at low peaks (Miller, 1965). Costa de Beauregard affirms that cybernetics will lead the definition of negentropy and information, understanding negentropy as non-entropic governance (Ibid.). As will be seen later, this aspect is essential since, if entropy is controlled and its levels kept low, the complex system can cover larger spheres of complexity without compromising its resilience.

As has been observed, if there are failures in the nodes or the superior subsystems, these failures are reproduced in the rest of the subsystems in the hierarchical direction; thus, depending on the complexity of the organization structure, the more significant number of levels there are, the greater the probability of an error. A situation of irreducible complexity occurs, where if a node fails, the failure of the rest of the nodes follows; it is its greatest vulnerability, called Single-Point-of-Failure (Cai et al., 2018).

As more context is covered, the behavior of the structure increases in a non-linear way, both at the energy level and at the level of loss/distortion of the information of the structure itself; this entails a tendency to entropy. Systems interact in a context, and centralized models are very efficient in simple contexts, in tiny spheres of complexity, but when the context becomes complex, centralized forms fall due to the inefficiency of their structure and the lack of entropy control. Centralized forms are not resilient to high levels of complexity.

This is different in decentralized models; in simple contexts, they are inefficient, but as the context becomes more complex, they become more efficient. Its most significant disadvantage is represented by the "Byzantine generals' problem," where not all are trustworthy, and consensus agreement is complicated. Something that, as will be seen later, the current decentralized forms try to solve through the forms of validation Proof of Work (Bitcoin) and Proof of Stake (Ethereum) (Johnston et al., 2014; Cai et al., 2018; Guerraoui et al., 2022). Instead, this research will seek ML to detect better ways of agreement with our data.

Although current public policies are better than old ones, these tend to fail due to the complexity of the policy-making process and the context (Ghaffarzadegan et al., 2011). In this same article by Ghaffarzadegan and his team, the elements that affect the definition and execution of current policy are described. As mentioned in the master's dissertation (Huerva, 2018), given the State's inability to respond to social demands, top-down policies seek to energize communities so that bottom-up initiatives emerge, which can be observed at work from Eizaguirre (Eizaguirre et al., 2012). As shown by (Ghaffarzadegan et al., 2011), the initiatives on self-organization processes over resources and the coordination of social action obtained satisfactory results. Individuals can configure emerging collective behaviors at the local level.

Based on the theoretical set of the technology reference section, this emerging behavior is possible thanks to physical technological tools that allow better interrelation to adopt a common behavior successfully, such as social networks, Telegram or WhatsApp, poster printing, Excel, emails, websites, blogs, or telephones. This help to establish common information and energy; it is not stigmergy but sets an everyday infrastructure based on high interrelation. Physical technologies allow the development of new forms of social technology. However, there is no single tool dedicated to this; there is no tool that gets emergence as a functionality of the device. At this point, the researcher begins to think about what that tool should be like.

Social relationships generate interdependencies, which make it possible to cover higher levels of complexity since where one individual does not go, the other can go; it is the way to add capacities. Interdependence can also be positive or negative, depending on the type of feedback from the interaction; if both win, the interdependence is positive, and if one wins and the other loses, it is negative. Interdependence is a relationship in which two or more elements depend on each other. Feedback is a process in which information about the results of a function is used to change the efficiency or effectiveness of that process. It is also inferred that positive interactions equal positive synergies, and negative interactions equal negative synergies.

In a complex context, centralized power limits interdependencies and the possibilities of encompassing greater complexity and progress. In this sense, it is important to understand the power relationship of one node towards the rest; it has already been seen that power nodes tend to concentrate it, and it can be observed in the study of "Dutch disease" (Frankel, 2010; Bunte, 2016; Mien & Goujon, 2020) that describe the paradigm of why countries with greater natural resources tend to be poor. The exception of Norway marks the path of explanation, as well as the countries without any natural resources to exploit, which are also shown in the upper part of the rich countries (GDP). Just like the changes in economies that cause the discovery of a natural resource, these are also the capacity of control that society has over the government, the quality of democracy in that place, the quality of institutions, and the less inequality of that society. These are also essential elements that prevent falling into "Dutch disease" and allow this resource to be well managed so the territory does not fall into poverty. This would suggest that the ability of the citizens of a country to govern themselves well to control a natural and common resource not only avoid the appearance of "Dutch disease" but also allows higher levels of progress, encompassing higher levels of complexity.

If the control of resources is concentrated and centralized, the probability of good management and redistribution is low; the likelihood of error increases as the structure increases, regardless of whether this centrality refers to a corporation, a State, or irrespective of the type of existing ideology. In this regard, the work of the team made up of Bruce Boghosian is particularly relevant, where they point out that the concentration of wealth follows a condensation dynamic, characterized as: "by the concentration of a finite fraction of wealth in the hands of a single agent, and it is thought to provide a statistical mechanical explanation of the phenomenon of oligarchy." In such a way that a high condensation is equivalent to a high concentration (Boghosian et al., 2015; 2017). Something that is also observed in other works: "(…) it is well known that these dynamics" - about the current redistributive dynamics - "leads the system to concentrations of wealth in the hands of few agents (oligarchy) and also the condensation of most agents below a shallow level of wealth" (Lima et al., 2022).

The work of the Boghosian team is important because: "This work also demonstrated that the time-asymptotic value of the Gini coefficient of the non-redistributive model is unity, corresponding to absolute oligarchy" (Boghosian et al., 2015; 2017). The Gini coefficient would provide information on the level of oligarchy in society and the effectiveness of regulation as a society's wealth distribution capacity. Understanding that an oligarchic system presents an ineffective distribution of wealth, the regulation of the system is not adequate. The greater the decentralized control of wealth, the greater the distribution of wealth; if a system distributes wealth adequately, it is equivalent to reducing the Gini coefficient. However, adequate is not everyone since people are diverse, and diverse include free-riders and people that do not have the information (or don't want) to manage the distribution of wealth.

Regulation is essential in any living system. Unregulated systems tend toward entropy, while the absence of regulation tends toward condensation (Boghosian, 2014; Lima et al., 2022). Cardoso and his team have shown that regulation improves economic mobility and reduces inequality (Cardoso et al., 2020). Therefore, the better a regulation is, the better it can manage resources, distribute them, and control oligarchic tendencies.

When a social organization is based on a centralized scheme that tends to create monopolies and oligarchies, regulation can take the form of either a single monopoly (the State) or multiple free-market oligarchies. However, both solutions have poor distribution capacity due to their centralized nature. Regulatory effectiveness increases with greater decentralization of power (a decentralized scheme where everyone with same information has control over resources). Examples of decentralization of power include the division of powers and individual governance, which lead to more effective regulation, less oligarchy, and less concentration of wealth.

Chapter III

12 Context, Current Situation and Complexity

The current physical and social context follows an exponential, non-linear projection (Ispolatov & Doebeli, 2014). Technologies generate more changes in shorter periods of time (Rosenberg, 1982; Kurzweil, 1999), and events can act as accelerators of trajectories and new contexts (Rymarczyk, 2020). Humanity has never dealt with as much complexity as it does now. Organizational models designed for linearity cannot respond to non-linear contexts like the current one (Richerson & Boyd, 1999). We live in a networked society (Castells, 1996), and current formal institutional organization forms (March & Simon, 1993; Perrow, 1972; Nieto, 1996; Fehl & Freistein, 2020), were born during the revolutions that gave way to modernity, linked to the technological changes of that time. The current formal institutional model was designed in the 18th to 19th centuries when knowledge and technological resources differed from today. Linear models of organization are efficient in simple ecosystems or with limited complexity but become less efficient as complexity increases (Anderson & McShea, 2013). IOs (International Organizations) produce and reproduce inequalities (Fehl & Freistein, 2020). Formal institutional forms, which were sources of wealth and progress in recent centuries, are increasingly becoming a hindrance to progress and are unable to respond to the new challenges facing humanity.

Throughout the dissertation, the contextualization process has been analyzed, validating the correctness of the described context as a valid starting point. The initial situation must be located accurately to define a trajectory toward objectives. The course and goals can be compromised if the starting point is incorrect. This trajectory has been understood as a set of vectors and the system's dynamics as a set of inertias, which are essential in defining the course toward the objectives. From here, the work follows the previous thesis line (Huerva, 2018), science is a process that involves changes and improvements.

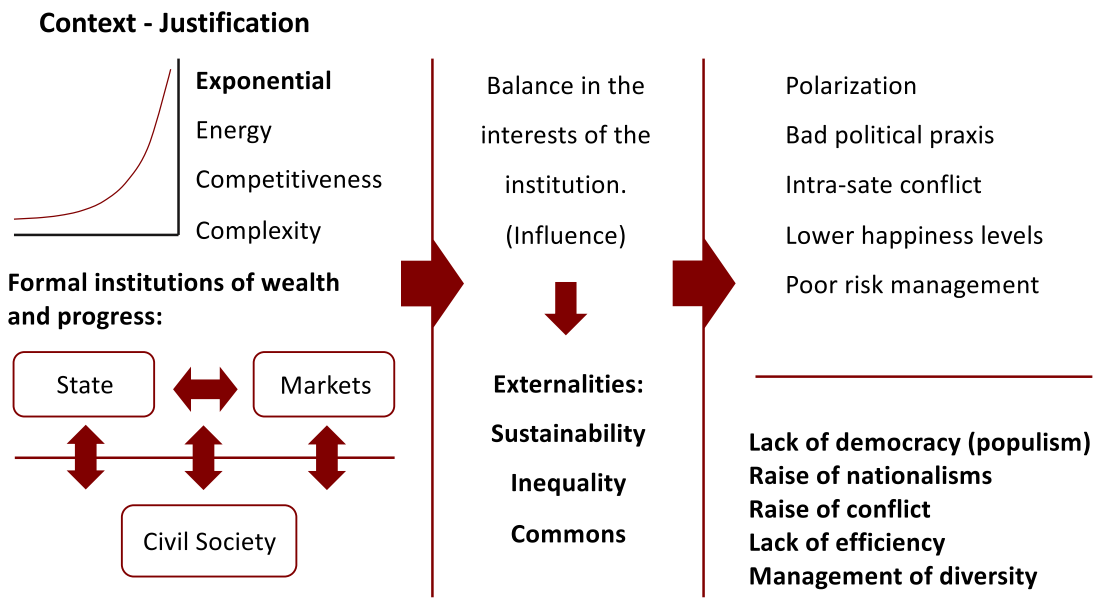

Figure 17. The current situation's scheme is updated based on the previous version (Huerva, 2018). In this scheme, one can see plutocracy, meritocracy, and ochlocracy.

Fig. 17 summarizes the context, current situation, and starting point in a diagram. In the upper left corner, it shows a scheme of change throughout humanity, including the technological exponentiality that Hanson, Diamandis, or Kurzweil talk about -both physical and social- as well as the system's complexity, competitiveness, and energy levels. In the lower-left area, we can observe the organizational model, the method of generating wealth, the current progress, and the social technology based on the pairing of States and markets. While one might argue in favor of either element of power/ideology to provide a social explanation, the reality is that both are necessary to form a complete model. "One requires the other, and the other requires one," so the two feed off each other. Additionally, civil society plays a vital role by energizing, interacting, and legitimizing this binomial.

The central part shows the power dynamics; the balance is found between the interests of the institutions, with the ones having the most influence establishing the "balance" or hegemony. This type of balance, defined by the power of influence, creates externalities in physical contexts, such as sustainability and resources, and in social contexts, such as inequality or management of the commons. At the same time in the right area, processes generate bad political practices, territorial conflicts, and problems managing complexity, which translate into populism and the fall of democracy, an increase in nationalism, polarization, or diversity management problems. Conflict, disorder, and a tendency to entropy and chaos are elements that the researcher interprets as problems of efficiency and effectiveness of the model that do not allow reaching higher levels of complexity or greater spheres of complexity (CSp_n). What is interpreted as the obsolescence of formal social technology to face the new challenges humanity must face.

From the perspective that this dissertation follows, inequalities[41] is an energetic inefficiency of the structure that leads to inefficacy in reaching new complexity limits. A scheme or model can afford to be inefficient (inequalities/non-sustainability) if it effectively handles complexity. However, as complexity increases, inefficiency (inequalities/non-sustainability) does not allow us to continue covering larger spheres of complexity. Inefficiency affects the effectiveness and, therefore, the ability to continue to cover larger spheres of complexity. It may be acceptable in complex contexts but implodes in more complex ones. The fact of understanding that there is a limit to current institutional forms and that this limit is defined by complexity and by the centralized structure is something that research has also observed in the work of Wulf Kaal (Kaal, 2019; 2020) and that it indicates that the argumentation that follows the investigation is not erroneous.

Externalities such as sustainability, inequalities, and management of the commons are better explained through the power component. This component acts as a crucial element that, in very complex environments, instead of promoting progress, limits it. The model was designed centuries ago when environmental sustainability or inequality was not as important as it is now.

12.1 Approach to the Solution, the Definition of Progress

A continuum of transformations is evident along the investigation through a concatenation between physical and social technologies. A change in the conceptions of the individual in the world that surrounds him defines his freedoms according to his explanation of reality. First, through a magical scheme that later becomes rational, in the process of constant change, where non-linearity becomes a problem and small causes have more prominent effects. Where the forms of control of power are closed, access to power is closed, but in which there are more and more agents of power since there are more powers now than before. In this transformation process, complexity is increasing; it is less and less elemental, just like the control structures that tend to be segmented to control complexity (MDF), which, although more dynamic now, continue to conform to a mostly "static" dynamic.

[41] Understanding that inequality is a problem of system efficiency, it can also be understood that an individual's capacities, projections, and possibilities are reduced or limited to reach new complexity spheres. To overcome as a society, the new complexities that humanity faces (contexts) mean that the model needs to be able to overcome this inefficacy.

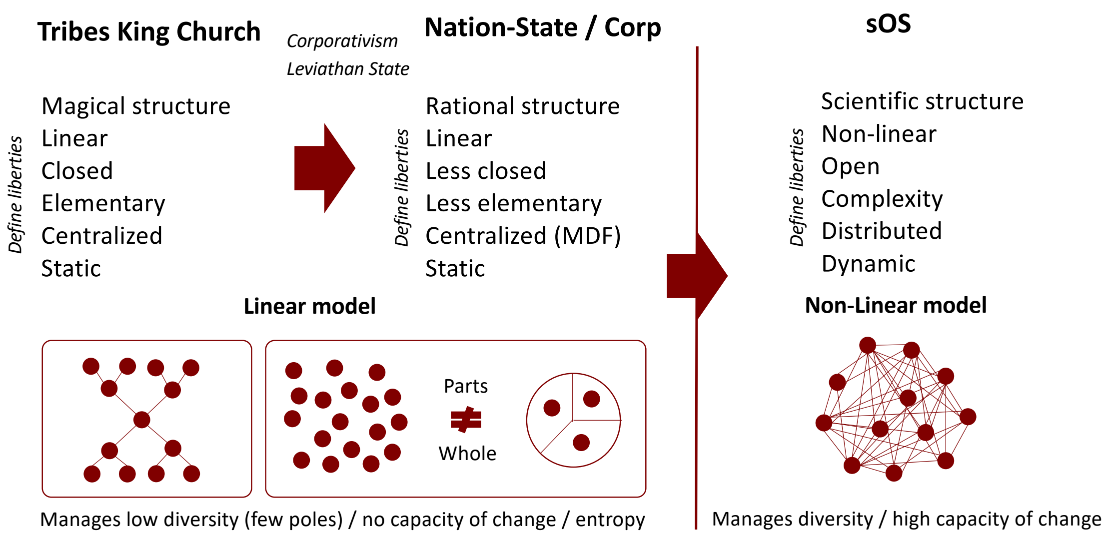

Figure 18. The scheme illustrates the transforming trend that develops throughout the dissertation. It is based on the contents of the Political Complexity curse in the Social Innovation Network (SI). On the right is the conceptualization of the model that defines the research to reach new spheres of complexity, in this dissertation, the Social Operative System.

In Fig. 18, the left side displays the starting framework: an organization based on a magical, linear prism with closed and static power. The society is of a more elementary complexity, with a centralized hierarchy. The central part shows the current situation, marked by a "rational" prism, following linear organization parameters. The power and the organization structure are still closed and static, although to a lesser extent than in earlier times.

On the right, one can see the model that can reach new levels of complexity or new limits of complexity. This will define the solution and, therefore, the objectives. This dissertation discusses the Social Operative System (sOS). This model is scientific; it understands the non-linearity of society and that the sums of the small actions of individuals have greater consequences. The model also reflects an opening of power, a greater decentralization, embracing complexity instead of trying to reduce it, and facilitating a greater dynamic. Dynamism is essential. When comparing a centralized structure to a decentralized structure, the latter implies a much greater emergent dynamic than a static centralized one (Kaal, 2019; 2020). This allows for better adaptation and change. Depending on how these components define the interdependence of society, the freedoms of the individuals that make up that society will also be affected.

At the bottom, it is highlighted how the sum of the parts is not equivalent to the whole, which relates to a democratic representation process. The information from the nodes cannot be easily reduced or segmented into groups of parties, as there is too much information to process, and some are lost in the process. Regardless of the perspective on power, there is a tradeoff between diversity and representativeness. Even multiplying the number of parties cannot guarantee representation when the diversity is more significant. "They do not represent us," read the banners of the Occupy movement in Barcelona and Madrid.

According to the master's dissertation (Huerva, 2018), the Institutionalist Theory suggests that the current party system no longer guarantees a good democracy, as the party's survival often takes precedence over the common interests of the inhabitants of a territory. In Brazil, despite a Chamber of Deputies comprising 30 political parties in 2018, this does not guarantee a good democracy, nor does it represent diversity or the ability to reach a consensus. As Hitler did in 1933, it is easy to argue that multiple political parties are useless and should be eliminated, but this is not a solution that upholds democratic values.

Moments of little representativeness, great diversity, and lack of consensus, or when the organization appears dysfunctional, do not adequately explain reality. Instead, these situations seem to provide fertile ground for the emergence of authoritarianism. According to Polybius' theory of anacyclosis, this would be affirmed since these stages coincide with partitocracies, plutocracies, or ochlocracies. It is understandable that society is vulnerable to leaders in such a context. A leader who can define a consensus - even if it is imposed - provides the security lost with previous non-consensus process and establishes a form of social organization that explains a new reality. In this way, democracy can be transformed into a monarchy, marking the beginning of a cyclical process.

The work suggests that representativeness causes a funnel effect. In a cybernetic scheme (Fig. 12), the quantity and diversity of information are equivalent to the inputs and outputs of the system, and the representative form is part of the transformation and feedback process. However, the amount of diversity of information (energy) is not adjusted to the political capacity, which is defined by a closed power dynamic. The non-linearity of the variety (context) leads to signal saturation, and the transformation block cannot absorb so much diversity due to its centralized power structure, resulting in an entropic tendency.

To correct signal saturation is to minimize diversity (less variety equals less complexity) which could be done by applying filters -such as crossovers- to limit the signal and unify diversity in different categories. However, this results in a loss of diversity, reduce the capacity for human projection, lead to the creation of stereotypes, and slow down the capacity to embrace complexity. For instance, China spends resources to control variety and create a stereotype of the "ideal" individual. In China, the Social Credit model (Liang et al., 2018) can make it difficult for those who do not conform to societal norms to find their place in society. Another way to minimize diversity is through nationalism and war. These unify a common behavior (signal), as anyone who steps out of a behavioral stereotype defined by nationalist values and who argues against war is "eliminated" because war becomes the priority.

As said in the methodological section, the researcher is wary of social determinisms, even if they refer to anacyclosis and the ways to control entropy by minimizing diversity. (Bastardas-Boada, 2019) cites Morin and argues that the solution to complexity is not to simplify or reduce it, but rather to develop a theory of complexity that encompasses and deals with it. In more complex environments, an open and decentralized social technology solution is more effective than a centralized one, as it provides greater control over both internal (structure) and external complexity.

The model that emerges from the investigation is focused on a result or output: the definition of social progress in the research. As mentioned earlier, this means effectively and efficiently encompassing greater complexity while minimizing entropy. The master's thesis defines achieving greater progress: Equalities + (ratio between heterogeneity and consensus) + Freedoms (Huerva, 2018). These elements allow individuals to cover greater complexity, and maximizing them leads to progress, so the social organization should be oriented towards these.

- The element of equality is a vital aspect that affects humanity's ability to progress. The higher the levels of equality, the greater the projection of humanity, both individually and socially. Reducing inequality is critical in confronting the challenges that humanity faces in today's complex context. It has been observed that inequality is currently hindering progress.
- The relationship between diversity (positive feedback) and consensus (negative feedback) is crucial[42]. An open society with a wide range of diversity requires much broader forms of consensus than current ones. Diversity is essential for progress; it provides a greater source of options for exploring and finding solutions. However, when diversity does not conform to an agreement, all of its projection capacity becomes a hindrance. When there is too much diversity and no consensus, progress is hindered, and society is not resilient to new contextual complexity. This also works in reverse: if there is too much consensus, a lot of relationship cohesion, a lot of harmonies, and low diversity, all this consensus also hinders progress. It is the feedback "balance" of the system.
- Freedoms are a key element for the development of individuals and the progress of humanity. Greater freedom to create and discover can be achieved depending on how society is structured and organized. The definition of freedom can vary based on the complexity of the environment. For example, an individual's freedom in a magical environment is different from that in a rational environment, or in an environment that does not understand non-linearity versus one that does. The freedoms in a centralized environment are not the same as those in a decentralized environment, and the freedoms offered by an open and dynamic society are different from those provided by a closed and static society.

The definition of progress requires a decentralized regulatory framework, which is important for achieving equality and freedoms, as well as for balancing diversity and consensus. At the same time, it is essential to establish how to control and maximize interdependence to address

[42] The researcher speculates that the optimal relationship between the two elements can be obtained when the variables that make up the diversity indicators and those that make up the consensus indicators can be defined. The different relations compared with the results from different groups. The researcher speculates that it may be a relationship between positive feedback and negative feedback. The calculation method could be similar to what is proposed by Neuhäuser' team (Neuhäuser et al., 2022).

greater complexity. This can be achieved by controlling transformation and feedback processes. According to this definition of progress, tackling higher levels of complexity would be possible. However, for this to occur, all nodes, as discussed in the section on emerging systems, must be identical, behave identically, and possess the same information with predictability. This is not the case in human society, as differences generate diversity, which is a crucial component for adaptation to ecosystems. This diversity has enabled humans to survive, subsist, and find solutions throughout history and for the future.

At this point, a model that enables the adaptation or conversion of a human system based on diversity and difference is conceived. This model represents an emerging system of equality and collective action, where the centralized approach to encompassing complexity falls short, and the emerging approach takes over. Technically, this model should be defined as a cybernetic system that leverages individual differences and each unique situation to build an emerging system of collective self-organization. In this system, people are represented through data and self-organize based on that data, allowing for agreements, consensus, and policies to be designed based on individual data.

The goal is to achieve a social model that allows emergent behavior through diversity and individual projection by means of equality and consensus.

12.2 Model Premises

To achieve this model, several aspects must be considered regarding the elements that compose it. In the master's thesis (Huerva, 2018), some key success factors and requirements were defined, which are expanded on below:

- The model for data management must start with individual and social empowerment, recognizing that individuals own their data as an asset they generate but do not control. Companies that collect data as a competitive advantage do not usually share it or use it for social purposes but rather for their own economic gain and to augment their influence. This results in a loss of valuable information for designing policies that benefit society and advancing scientific research (Connelly et al., 2015). As a result, much of this knowledge is held by corporations, as confidentiality contracts prohibit the publication of internal results or customized methodologies for using the data.
- This investigation is based on the premise that individuals' data is an asset exchanged for services when legal policies are accepted. Therefore, developing new data control forms that take advantage of available technology while incorporating consensus and social decision-making is critical. This approach is necessary not only to control the data of individuals but also to find forms of consensus that allow us to understand the relations of production in ways other than those that make up the current hegemon[43]. As Fiske

[43] In The Future of Global Conflict (Bornschier & Chase-Dunn, 1999), a hegemon is defined as a country that dominates other countries through credit relations.

said, market dynamics mark some relationships (Fiske, 1992), a wide characteristic of contemporary capitalism. That infers on creating aggregate economic wealth but not on social wealth, social capital, or subjective well-being.

- Due to the new paradigm created by data technology, the model must strike a balance between privacy and transparency while remaining reliable.
- The model must allow economic empowerment, greater accessibility, and efficiency present when managing resources and making decisions about them.
- The model must demonstrate the behavior of an emerging system without relying on a centralized entity. It must be based on the interactions of individual elements, with their independent behaviors defining a collective behavior when scaled up to a higher level of organization. This requires finding a form of stigmergy that can be applied to a human system.
- The model must establish a decentralized self-regulation framework that allows for decentralized regulation agreed upon and consented to by all. This involves finding a way of stigmergy that can be applicable to a human system.
- The model must handle complexity by using empirical and scientific tools. This will allow for the detection of social emergencies in a more efficient manner and enable the anticipation or creation of new policies (Cook, 2014) or micro ad-hoc policies for individuals. By doing so, we can improve individual and social decision-making in both physical and social contexts. It is not unreasonable to think of human beings as similar to algorithms, especially given the computational development we are experiencing today. Longitudinally monitoring all individuals allows us to extract patterns and trajectories and to have predictive capabilities.
- In complex environments, the risks of power concentration displayed by organizational structures make them inefficient and increase the chances of making bad decisions. Therefore, the model must control the concentration of power through decentralization.
- The model should improve the efficiency of complex organizational structures. This is because the efficiency achieved by centralized organizational structures when managing less complex environments becomes inefficient when the environment becomes more complex.
- The model must find interdependencies of the elements that compose it according to the derived positive and negative feedback processes.
- The model must be inclusive and dialogical, capable of handling different and opposing conceptions a priori in order to yield positive results.
- To ensure the self-organized model's sustainability over time, it needs a stable energy source and must be able to finance itself independently. Information is energy, and humans are data generators.
- The model must be sustainable over time and resistant to changes. This key success factor is linked to self-sustainability and resilience; a resilient system is self-sustaining.

Additionally, the dissertation recognizes that environmental sustainability is a problem of social organization. The model should be able to organize individuals for the new paradigms of ecological sustainability.

- The organizational model must be self-sufficient and self-governed to be emergent and resilient. This impacts the concept of freedom, from the traditional idea that freedom is achieved when others don't control it, to the more modern concept that also includes individual freedom. Based on the structure shown in Fig. 8, it can be assumed that the freedoms within the organization will transform.
- The model should minimize and better manage individuals' and society's risks and uncertainty. It covers greater spheres of complexity (CSp) and defines new risk limits (the edge of chaos). "Moreover, the model should provide a more accurate assessment of the likelihood of risks, which can assist in decision-making and help prevent negative consequences. Identifying potential risks before they occur can also help reduce any negative outcomes' impact. Overall, it must have the potential to greatly improve risk management practices and enhance the safety and well-being of individuals and society" (notion AI, 2022).
- The model should consider both top-down and bottom-up actions. Decentralization has been a process where bottom-up actions gain more strength over time. This characteristic is due to technological democratization and greater accessibility to tools and knowledge, which gradually defines actions more and more by a greater component of bottom-up action. Although it is a trend, change will not only come from this bottom-up vector. Power dynamics must also be considered; it is important to remember that changes are defined top-down, from few to all.
- The model must be accessible, universal, adaptable, and scalable.
- The model should enable the creation of a social contract among individuals without an intermediary entity (P2P). This is because the intermediary can distort the signal (power), affecting their relationship.
- Similar to the genesis of the conception of the State, the organizational model should be unifying. Being part of the model should be more worthwhile than not being part of it. The union of many agents with little power gives the model greater strength (long-tail). AI techniques must be able to control relationships (interdependencies) for this to happen.
- The model must allow the correct transferability from the current situation and consider the political and economic trajectory and powers.
- The model must generate social impact following the SIOR indicators and the United Nations Sustainable Development Goals.

12.3 Conceptual Logic of the Model

When it is exempt from power dynamics, it is considered that the most "natural" human way of reaching consensus is through an assembly, promoting collective intelligence. And that this assembly increases in complexity (energy/information/efficiency/efficacy/error) in a non-linear way as one more component is added to it, one more individual, since an assembly of 5 people is not the same as an assembly of 50 people, the amount of information, time, information processing or energy required is much higher (efficiency and effectiveness ratio).

As previously discussed, brokerage elements, hinges, control/power nodes, or representative elements are created to make the decision-making process more dynamic and effective. This is a way to segment complexity and cover it from a centralized perspective. However, these control and representative elements are not practical when the system encompasses higher levels of complexity or diversity, as previously noted. While executing a joint action among 10 people through an assembly is feasible, an assembly of 1000 people is impractical. In this case, the option for collective decision-making is the representativeness and segmentation or classification of these 1000 people (representative democracy). However, even this segmentation will have a limit when the complexity (diversity) is even higher. It is impossible to run an assembly among several million people due to the lack of cerebral or temporal capacity to handle so much information. The current representative form (centralized) cannot encompass such complexity either.

Based on the theoretical framework presented in the dissertation, the researcher aims to create a tool for direct communication between individuals. To achieve this, this work conceptualizes and designs a logic for assembling AIs that can communicate with each other. This model starts with the individual, considering their characteristics and differences. The data generated by individuals include these differences, these attributes, and their AI compares this data between them to reach consensus in a decentralized manner, without the need for control nodes, since the entire process is direct between the agents (P2P through AIs).

There is no one artificial intelligence that predominates over the rest and designs policy based on the data of each individual. Each one has its own artificial intelligence, and they all communicate with each other using their AI. The sum of these AIs creates the basis of an emergent system: a decentralized artificial intelligence system capable of improving interdependent relationships.

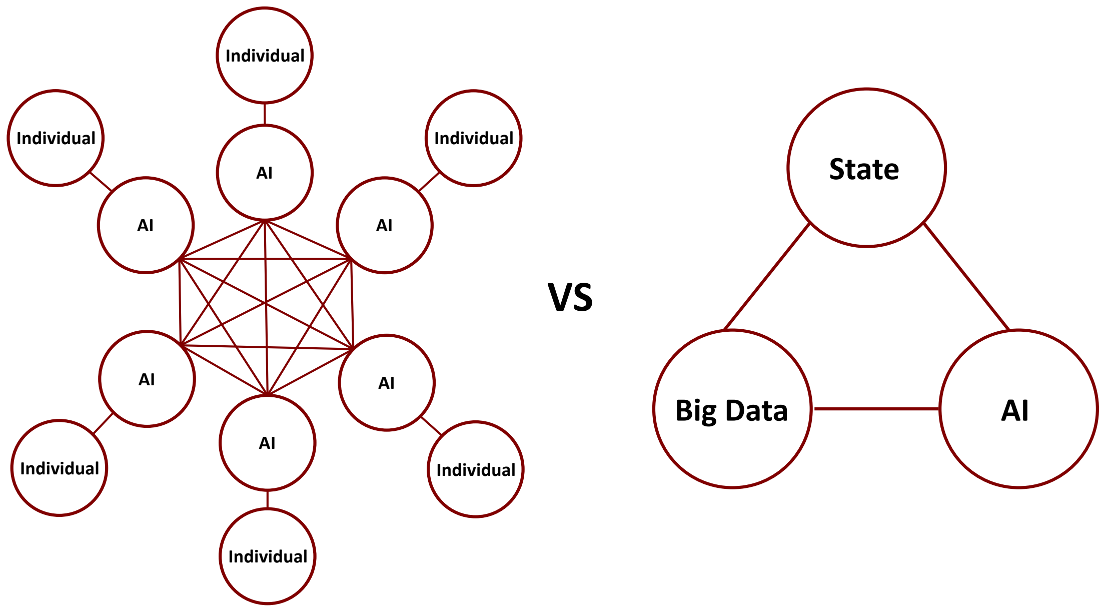

Figure 19. On the left is the model advocated by the research, and on the right is a centralized model, such as the one used by the People's Republic of China. In this late model, individuals are included as an appendix of the big data dimension, and the State dimension controls the monopoly of AI, which in turn controls society. (More in Bostrom, 2016).

The proposed model will consider the freedoms of the individual that are defined by the characteristics (limits) of the framework, illustrated in Fig. 18. Each individual owns all AIs, and their interconnection allows for control and anonymity of their data. By defining these two sets - the individual set (nodes) and the collective set (links)- a system of high interdependence and controlled feedback is created (hybrid model). This system is much more efficient because it eliminates intermediary elements that can exert distortions of power -or information (depending on the discipline)-, that would ultimately affect the rest of the system (individuals). In contrast, the counterparty model requires much more energy.

The previous work proposes a model consisting of three technologies: 1) data technology, 2) processing technology and machine learning, and 3) distributed technology, DLT (Huerva, 2018). Since then, the researcher has been exploring ways to build the model. In 2020, the researcher came across several relevant publications, including (Lopes & Alexandre, 2019; Kaal, 2019; Aditya et al., 2021) and the NuNet whitepapers, as well as SingularityNET[44] (SingularityNET, 2017) and others. These publications support the idea that connecting AI and blockchain is feasible and confirm the logic followed in the thesis. They provide technical guidance on integrating AI with blockchain and applying it to various use cases, including robot coordination, cooperation, and asset transactions.

[44] Lopes & Alexandre's article refers to SingularityNET, a decentralized AI project that the researcher has closely followed in the community on Discord, even before its ICO, also having the opportunity to participate in the first private sale. The researcher declined; the objectives of the thesis are not economical or speculative. Most research projects in crypto markets have become more speculative and less research.

The scheme of the model follows a structure based on the control of the interdependence between individuals defining the framework. A data system that allows individuals to own and control data as an asset. It improves their security while allowing the first step towards political and economic empowerment, enabling design policies through these. This data system feeds a computing matrix, which allows the computation of data for decision-making, a personal and collective decision system based on the data of individuals for the design of consensus and personalized policies. Due to the inherent perversity of these elements, the model requires a decentralized system to control the model, a Decentralized Autonomous Organization (DAO). All these elements define social dynamics (self-regulation).

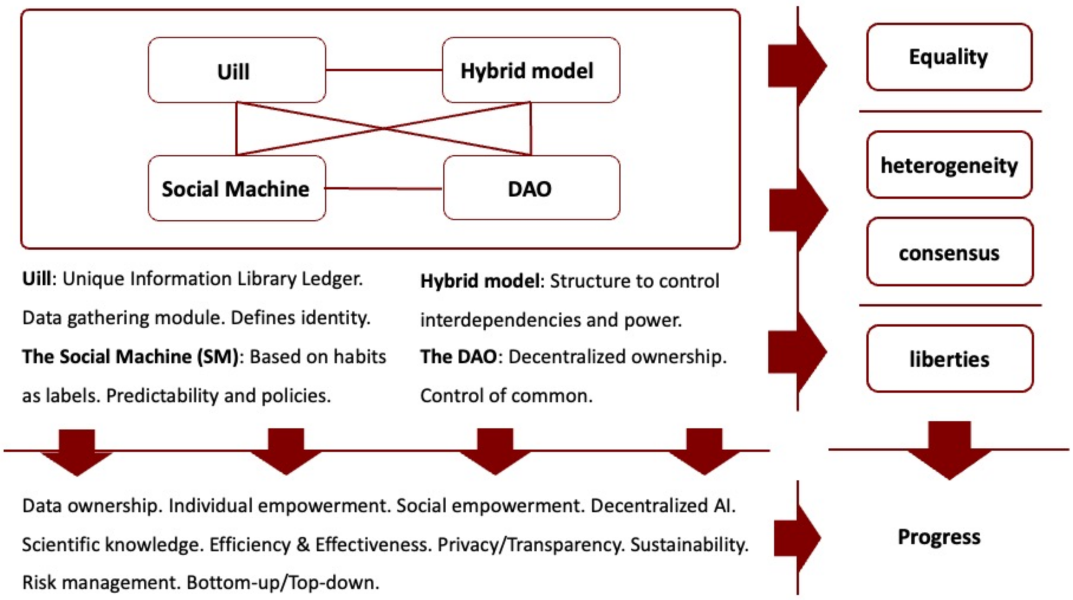

Figure 20. Scheme of the elements that compose the model and the relationship with the goals of the research.

In the following sections, we will discuss the emerging social organization model. The research will cover the control modules, followed by the data modules and processing modules. Before anything else, it's essential to consider the technology behind the control modules. Specifically, the DLT technology functions through a decentralized system. It's crucial to understand the drift in which this technology is utilized.

13 Distributed Ledger Technology (DLT).

DLT technology allows for the emergence of a social element, which is where its power lies as a democratizing and empowering force. This dissertation analyzes the characteristics of this technology and clarifies that financial applications (DeFi) and crypto market experiments are only a part of the possibilities offered by DLT, and that there are many more. It allows all nodes to participate in decisions and organize and build cooperative and productive systems more naturally

(Bollier et al., 2015). It also enables much more efficient forms of social organization (Riemann & Grumbach, 2017), in a self-managed way (Scott et al., 2017).

It is a technology that can bring together liberalism and socialism on the same track: "And it is not only the model of efficiency and de-bureaucratization that DLT technology offers, but it is also the properties that position it on the slope of socialism, such as community property, egalitarian values or transparency (Scott, 2016), but simultaneously with the characteristics pursued by liberalism, such as property control, bypassing the State, the personal interests of the individual, or the protection of anonymity (Yermack, 2013; Karlstrom, 2014). Establishing decentralization in an ideological space in another paradigm from the 19th century (socialism/liberalism), and where even anarchist conception also has a place (Huckle & White, 2016)" (Huerva, 2018). This technology reminds the researcher of the dialogic principle that helps to embrace complexity.

Manski analyzed the pros and cons of DLT for the technological community. The benefits of DLT include 1) disintermediation, 2) veracity, and trust, 3) control of information, 4) secure decentralized networks, 5) transparency and immutability, and 6) efficiency. However, there are also some negative effects of DLT, such as a) the immense information processing capacity required, b) the necessary energy consumption, c) the deregulation of a central authority, d) inadequate privacy control, e) the need for adaptation to technology, job losses, and f) companies exploiting regulatory loopholes for their own interests / free riders (Manski, 2017).

As will be seen, these elements have been considered when conceptualizing the model. Likewise, the analysis by Darcy and his team shows that new technologies, such as blockchain, can replace institutions (Darcy et al., 2020). An article that raises a problem similar to the one this work faces has also been analyzed, specifically on biological and common data, privacy, and perversity (Evangelatos et al., 2020). And they propose a blockchain solution to access people's health data between health agencies. A similar article has also been found in exploring decentralized forms of government (Lemieux et al., 2020); it has a very similar vision to the present investigation and reaches conclusions to the previous dissertation (Huerva, 2018), consolidating at the same time that the object of this analysis is not a single concern.

13.1 The DAO Application

The researcher first learned about the DAO throughout 2017, looking for information in a MsC degree project. It coincided with the recent exit-fall of the first DAO, "The DAO," Christoph Jentzsch's project. The researcher did not think at that time that the DAO would take on such relevance for his future research; at that time, there was not much information about what a DAO[45] was; it was simply the ability to organize assets by adding smart contracts (Aditya et al., 2021) developed in a programming language called Solidity, based on the "new" Ethereum (ETH)

[45] Werner Dilger is the first to speak of Decentralized Autonomous Organizations and concluded that at that time, technology could not offer this concept; it did not allow it to be executed (Dilger, 1997).

protocol. There was no scientific bibliography, no precedent, and a forum, ¿DAOhub? where there were few people. The little information was published on Medium[46], and the driving team behind the first DAO was Slock.it. Aragon (ANT), the platform to create DAOs, was the idea of two Spaniards. They made an association and reached the necessary investment of 25 million dollars in less than an hour; it is currently one of the benchmarks as a platform to develop DAOs. A DAO is an organization based on DLT technology.

The history of "The DAO" can be seen in (Report of Investigation Pursuant to Section 21(a) of the Securities Exchange Act of 1934: The DAO, 2017), also in (Campbell-Verduyn, 2018), and in The DAO Whitepaper (Jentzsch, 2016), in (Wang et al., 2019) as well as in Kaal's analysis of DAOs, (Kaal, 2020). This DAO was created to obtain economic benefits and can be considered a more advanced version of a Venture Capital Fund. In its first month, it was worth more than 150 million dollars, and with the rise of ETH, it came to be worth more than two hundred million dollars in three months. The accounting operation can be found on GitHub[47]. Investors bought The DAO tokens with ETH, which could be used to finance projects and enable voting proposals. The number of tokens represented the voting power of investors. In addition, these tokens could be resold; it was a fund with a high degree of decentralized control. Finally, The DAO had a group of curators from Slock.it who controlled the proposals.

The vulnerability of The DAO was found in the Split DAO function. This feature allows a DAO to be split in cases of non-consensus, without disadvantaging the minority. Assets are transferred to the minority, called a Child DAO, allowing it to carry out projects and investments. The "attacker[48]" took advantage of this feature by creating many Child DAOs. This went undetected for a few days and resulted in a "draining" of the DAO. The attacker was able to drain 3.6 million ETH, equivalent to 50 million[49] dollars at that time. Eventually, a group from the DAO had to carry out the same draining process to stop the attack.

In the old slock.it blog, Jentzsch reflects on what he learned during that period (Jentzsch, 2016). In his conclusion, the researcher highlights:

1. These are the beginnings, security will be achieved with experience, as well as technology is immature, but it must advance.
2. Developing governance and voting mechanisms adapted to decentralized systems is necessary. Since the individuals that made up the DAO were looking for leaders to tell them what to do, a similar conclusion will be seen later in the first test, where, for a DAO to work, there must be a self-organizing culture, an

[46] https://medium.com
[47] https://github.com/blockchainsllc/DAO/wiki/Understanding-the-DAO-accounting
[48] The researcher remembers having seen at the time a blog entry or a post in a forum by someone who was recognized as the "attacker." And that justified the drainage because nowhere was it mentioned that this could not be done. The post or blog entry has not been found, there is no source, nor does it interfere with the development of the dissertation.
[49] Calculating ETH with a value of $20, currently, ETH costs more than $1000.

emergence culture. Technology can make it easy, but the individual must also do his part. This leads to the following:

3. The lack of a central authority for quick decision-making was a major shortcoming in developing The DAO. The individuals took posts from the creator of ETH as decisions when he only gave his opinion; it seems that people need leaders in moments of uncertainty and risk (where the form of organization does not explain reality).
4. It is essential to roll out gradually and be cautious with the concept of complete decentralization.
5. Smart contracts should be easy and simple.

At this moment the researcher realized that the decentralized technological ecosystem, mainly blockchain, is complex and understood by only a few who have a good grasp of developer jargon and human-machine interfaces. Creating smart contracts is not something everyone can do, which creates a gap between those who know and the rest. For the decentralized context to truly democratize and become accessible, managing smart contracts must be simplified so that individuals without coding knowledge can create their own. While the discourse is about democratization and accessibility, the reality is that it is not accessible to everyone, creating a new power dynamic for those who master the technology (Frey, 2019). Breaking down access barriers is crucial to prevent this.

Since then, a lot has changed; Slack.it no longer exists, and in 2020, the people who were part of Aragon left the association because they no longer felt identified with the original values; they claimed that the organization had lost the values that characterized it, as well as the transparency of the direction (Blockchain Observatory, 2021).

The reality is that many blockchain applications use decentralized technologies, but with a market scheme of companies, where a few wins a lot, and many lose, Crypto-based markets are "machines" for creating and bursting bubbles. The situation is paradoxical; Liu's team sums it up very well. "Because technology is stratified, a large number of employees are reduced to a less disposable population, regulation is reduced, and corporate personnel is technologized. While the mainstream trends in blockchain technology are greatly believed as distribution, decentralization, and democratization, the most powerful blockchain applications are likely to exacerbate inequality" (Liu et al., 2021). The researcher can see that most of the DAOs have become "machines of inequality", the validation methods, such as Proof of Work (PoW) or Proof of Stake (PoS), have negative feedback and do not help to reduce inequality. Despite discourses of social empowerment, only a few benefits. This is also evident in the analysis by Wulf A. Kaal on DAOs and their application to forms of corporate governance (Kaal, 2020). Furthermore, this technology is being used by the neoliberal position to overthrow the state (Garrod, 2016) and privatize it (Atzori, 2015), creating a new, more extreme version of capitalism. At this moment it must be taken in consideration The Miths of the DAO (Kaal, 2022): 1) the primary function is fundraising, 2) DAOs are scams, 3) DAOs are ungovernable, 4) "Code is Law" Fallacies, and 5) anonymity leads to bad actors.

The first part of this section is an example of how knowledge and technological techniques can improve society, for the individual, and for the common, DLT is not normative per se, but its possible applications. The second part shows part of the reality, a different application of DLT technology based on blockchain as an economic development of this technology; the researcher considers crypto markets, as well as DeFi applications, as a real experimentation environment. However, economics explains one part of the individual and society, and the applications of this technology are quite more extensive.

14 Control Modules

This conception of DAO and the technological drift that it has just seen is far from the path that the research should follow. If the individual with the most work or investment capacity holds the greatest voting power ¿where is the element of emergence? Some centralized companies or corporations use decentralized technologies like DAO to generate profit. However, such a design does not promote equality and is not conducive to the research definition of progress, scientific orientation, objectives, or a comprehensive understanding of complexity.

The researcher considers Elinor Ostrom, the State, and the markets may probably be less appropriate than self-organization for the sustainable exploitation of resources, the commons, or the safeguarding of patrimony and assets (Ostrom, 1990). This is why the researcher has conceptualized a DAO that follows the premises of the model and is consistent with the argument of this dissertation. What will be shown is a Decentralized Autonomous Organization designed from the perspective of complexity and the trajectory indicated by the theoretical set of this dissertation. It is a model that starts from a validation and regulation scheme that is different from the rest of the DAOs. It is emerging and is defined by a bureaucratic form based on the control of interdependencies.

The argument begins with the form of validation of the DAO that makes up the regulation. First, when writing this thesis document, eighteen protocols use blockchain (type I dApps), which has been increasing. All focus on communication between machines, asset transfers, and security; the human factor is only in the decision on some assets, usually financial.

Parameters	Permissionless	Private	Consortium	Hybrid
Network	Decentralized	Centralized	Centralized	Hybrid
TPS	Low	High	High	High
Visibility & Participation	Open	Restricted	Restricted	Varies
System Governance	Hard	Easy	Medium	Varies
Security	Varies	High	High	High
Examples	Bitcoin, Ethereum, EOS	MultiChain	Hyberledger Fabric	XinFin

Figure 21. A scheme that displays the different types of blockchains, which are generally classified based on their accessibility between public or private, or by their permission and validation system, which are differentiated between open or closed. This scheme is extracted from (Cai et al., 2018), although it is similar to others found in the analyzed bibliography. The Hybrid column stands out as a mixed system between the characteristics of a public and a private blockchain and by the type of validation, open and closed. The model that defines this thesis would fit into this last typology since it is the only one that is flexible and conforms to Fig. 20, thus adapting to the requirements posed by complexity and Transactions Per Second (TPS).

Validation is essential in decentralized regulation, Blockchain is a type of DLT application where assets are divided into blocks, and validations between blocks are carried out cryptographically using a decentralized procedure between computers. This can be done through PoW (Proof of Work) or PoS (Proof of Stake). The former follows the premise of "one computer, one vote", where whoever does more work (mining crypto for example) gets more benefits. In practice, this means that whoever has a more powerful computer earns more, which generates inequality through negative interdependence. The latter follows the premise that whoever has more property or invested more obtains greater benefits, generating negative interdependence.

This validation process creates a chain of blocks, known as hashing, which cannot be easily extrapolated to society. People are not just blocks of economic assets ruled only by market dynamics or with one rational behavior only; social reality is more complex than blocks of economic assets. Social interactions involve dialogue, reflection, cognition process (dissonances), and learning, which generate interdependencies. Depending on the feedback of these interdependences, it will cover greater spheres of complexity individually and socially. This is why this dissertation must conceptualize and design a form of validation of blocks that span them.

So, this work suggests that society can be computed through blocks, and this will depend on a) the truth that the blocks represent (legitimacy), b) the diversity of blocks that the network manages (heterogeneous information), and c) the diversity of forms to relate and agree that the network offers (consensus). These three conditions give rise to a vast amount of data that represents both individuals and society. The model is similar to a CAS with human labels. These labels are dynamic and define relationships through a neural learning scheme that involves all individuals of all AIs that comprise the organization. This represents a form of basic validation for self-regulation where there is legitimacy, informational heterogeneity, and consensus. Where each AI knows its information (of the individual) and the other AI's information (other individuals).

In other words, tags allow the stigmergy necessary for emergent behavior. Unlike an emergent system such as ants, human systems cannot generate pheromone trails. But we create a lot of data, traces, and inadvertent information; comparing it between all individuals generates much more information than pheromones can generate. In an emergent human society, stigmergy would be the information not from pheromones but from our data that activate or deactivate protocols, actions or smart contracts. In that case, this information can be represented by the labels configuring the data that arise from individuals and processed by the AI of each individual.

14.1 The Hybrid model, an emerging bureaucratic form

As previously stated, the goal is to achieve a system that allows emergent behavior through diversity and individual projection by means of equality and consensus. This is achieved through what this research calls a hybrid model because it involves the human and machine domains. The human domain refers to the human dimension and validation tasks. The machine domain refers to the connections between human dimensions to better perform the validations and tasks according to the result that defines progress. The hybrid model has been designed to respond to five reasons:

14.1.1 Emergence Converter

The first step involves converting a non-emergent, centralized, and diverse human structure into one that exhibits emergent behavior. As seen in Sawyer (Sawyer, 2005), individuals and groups can display emergent behavior and positive feedback depending on how they are connected and based on their interdependence. However, by default, they are distinct (possessing different information and perceptions) and, therefore, non-emergent.

Humans can generate lots of data that can be captured and processed as stigmergy. The model's logic is based on a data matrix composed of all individuals' AI, which shares and computes data, compares all functions f(x), compares themselves, and creates classifications, groups, and labels. The model defines the organization of individuals according to emerging criteria, controlling the interrelation and interdependence of nodes by calculating the prediction of labels and the creation of synergies. Higher levels of synergy should lead to increased freedom, consensus, projection, and diversity of nodes while also performing tasks. The technology allows for better control of the links between the nodes, which are as important as, if not more important than, the nodes themselves for efficacy (Ahn et al., 2010).

14.1.2 Transference

The human tasks relate to the second reason for the hybrid system. Based on research and the writings of (Kurzweil, 1999; Hanson, 2008; Frey, 2019; Guillén, 2020) among others, technological transformations have non-linear effects and can cause instantaneous, unforeseen episodes that generate social dislocation and result in consequences such as the "Engels pause"

(Frey, 2019), the "shock of the future" (Toffler, 1970), and social inertia. As discussed in the section on social transitions, technologies can displace many workers or agents, causing conflict regardless of their previous power or status. The bureaucratic system has been in place for several centuries, and it holds significant power. It cannot be said overnight that AI will replace these workers, which generates conflict.

There is enough knowledge and experience to prevent conflict and manage technology in a conciliatory manner between opposing positions. The hybrid model should bring two opposing positions closer together so that both can benefit. This is why the model should allow for a transition from the current situation and maintain bureaucratic tasks for workers (human domain), albeit with a different structure (machine domain). The model follows the trend of democratizing bureaucracy.

14.1.3 Bureaucratic definition

"Dynamic governance systems are becoming an evolutionary necessity" (Kaal, 2020). This investigation is focused on developing the foundations for sustaining a DAO and considers new forms of bureaucracy (Dwivedi et al., 2021). To execute this, a framework must first be created, followed by the form of validation and execution of tasks and decisions that seek consensus among individuals. This approach will allow the group to fully utilize its capabilities to find and execute successful solutions while also enabling stable self-governance. In other words, a bureaucratic process must be created to encompass dynamic complexity that allows for rapid change in the face of rapidly changing contexts and that will enable us to define new frontiers of complexity.

After reflecting on the various social contracts, it becomes clear that each one is defined by the aspirations of society, with the threshold set accordingly. The hybrid model allows for the establishment of a new threshold. An egalitarian bureaucratic approach that values diversity and consensus allow for rapid coordination of social action in response to society's challenges. This approach is effective in dealing with complexity; transparent, controlled by all, and owned by all.

14.1.4 Link between Domains

The fourth reason is related to technical aspects, which involve managing, securing, and validating the data that comprises the Uill and its communication with the Social Machine. This requires controlling the data and creating links between individuals. To accomplish this a DLT framework that supports smart contracts can be used. The smart contracts validate and verify access to personal data, the Uill, and its communication with the Social Machine. The Social Machine compares data and extracts the labels and values needed to configure a bureaucratic sequence. As will be shown, these smart contracts, or tasks, link the machine and human domains. The current open-source resources allow for the development of a decentralized platform without depending on other existing ones[50].

14.1.5 Human and Data Validation

The fifth reason is that PoW and PoS validation forms do not offer a comprehensive solution to the requirements of the model; they only provide a part. In the scheme described in this dissertation, validation is done through the data and labels of each individual, with the validation being human. Without finding a formal name already, it is called Proof-of-You (PoY) because it is a human validation legitimized by the individual, either because of human work or because the individual's data validates it.

The DAO should not be tied to the value of a third-party cryptocurrency. However, if necessary, ETH or one of several existing cryptocurrencies can be used for testing purposes. It is worth noting that the transactions described in the example matrix (Fig. 30) in the DAO section are shown in euros. Using a common currency fiat instead of a cryptocurrency has several advantages. Firstly, it allows people to understand a more familiar parity without conversions or wallets. Secondly, it can be integrated into the current economic system, or a crypto euro can be created to facilitate a transition. Thirdly, it moves away from ideas and preconceptions that may be associated with speculative forms that vary their value. Finally, the saturation of cryptocurrencies is also a valid concern. However, if creating a cryptocurrency is necessary, it can easily be done.

[50] DAOs currently use Snapshot as a governance platform for proposing and voting. It has open control of budgets and items. If Gnosis is added, secure asset transfer protocols in the DAO through PoS can be enabled. In this way, a powerful form of governance is obtained, which, from the perspective of current capitalism, generates greater interdependence. However, it is poor (not optimized) in terms of feedback for that interdependence.

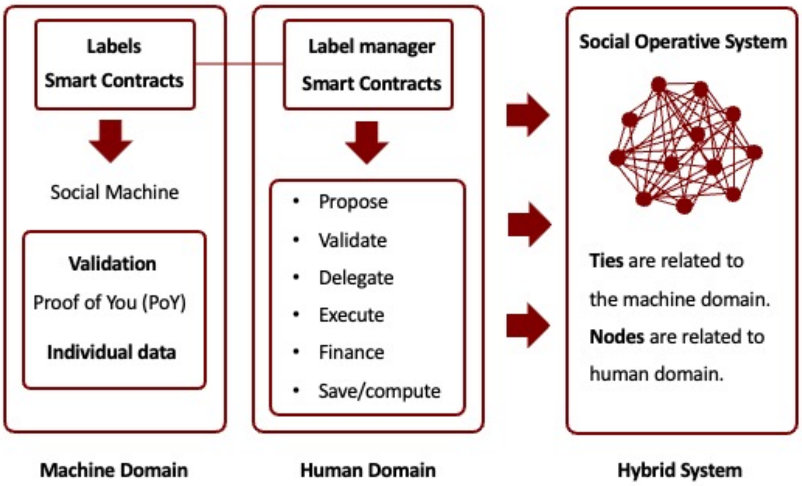

Figure 22. The hybrid model's scheme comprises the concatenation of the human and the machine domains. The human domain focuses on the tasks, and the machine domain performs the links to achieve the tasks. It references the links, validates, and calculates the interdependencies through the social machine. The relationships between both domains are labels and smart contracts. Source: own.

The forms of validation used in blockchain (PoW and PoS) require complex computations. These computations can be used for many automated tasks, such as transfers of assets, data, or communication. By using decentralized regulation, they can be optimal for managing asset management resources or "pay per use" systems more effectively. However, many other tasks and aspects define the identity of people and society and require more complex human validation rather than market-economics mechanics. This is where PoY (Proof of You) makes more sense and where both domains can come together to perform tasks.

The model that follows the research, the tasks or smart contracts allow self-organization: proposal, validation, execution, delegation, computing, and financing, which humans carry out. In this model, the "Proof of Work" characteristic of bitcoin would be a human validation, of a human-executed task (made by humans), according to the data that identifies that individual (PoY).

As initially seen, technology transforms work, forms of production, and human relations, but it does not eliminate them. The jobs, tasks, will, initiative, restlessness, or exploration do not disappear. The hybrid form allows a dynamic organization of P2P teams without a centralized element per se but by controlling the interdependencies between individuals based on a progress result. Based on this hybrid form, a much more effective bureaucratic dynamic can be created.

14.2 Decentralized Bureaucracy

As has been noted, bureaucracy, as a tool, from a functionalist perspective, is the mechanism that executes, coordinates, and energizes the tasks of a system, makes the whole work, and is part of the transformation and feedback element of a cybernetic system (Fig. 12). Nieto, Weber, Machiavelli, or Greene, among many others show a perspective of power, the bureaucracy turned into a powerful tool for those who control it, with an arbitrariness that follows their interest. As previously observed, the bureaucracy is a technology, a tool, and has the attribute of power that appears as a conditioning and limiting system factor.

The perspective followed by the research understands bureaucracy as part of the transformation process (Fig. 12), which establishes mechanisms and processes avoiding the power interests they generate, allowing the management of all individuals and civil society without interference. The approach that the research develops understands that considering a centralized bureaucratic system is the threat that this node develops its power for its interests, the best way to control power is by decentralizing it, as in the example of the division of powers, or also by creating other nodes that control that power node. The very concept of centrality in the new fragmented structure inherently generates the threat of an alignment of minority interests in power.

This problem disappears in the decentralization paradigm. However, decentralizing the bureaucracy does not make bureaucracy disappear. Some blogs and anti-State ideologies suggest that decentralization means the disappearance of the bureaucracy (decentralization as no regulation, seen before in Prudhomme). And although technology has always automated workplaces (energy vector), many people have been displaced as part of the transformations of industries. However, technology has also offered waves of empowerment, leading to more governance by more individuals. From the research perspective, because it is an emerging decentralized system, all individuals (AI) are part of the bureaucracy, and individuals are the bureaucracy. As will be seen, it is a dynamic and ad-hoc system.

14.3 The Bureaucratic Logic in a Decentralized AI, the Control of Interdependence

The logic of smart contracts is intended for nodes, the individuals (human domain); depending on how they are, the links are arranged in one way or another (machine domain), controlling feedback and predicting synergies and progress capabilities. Configuring between both a bureaucratic function and conceived for:

1. Promote consensus among all parties during the processes from beginning to end; if there is arbitrariness, it will be shared, deliberated, and agreed upon.
2. Human control of the validation and decision, not only a technological control (AI). At this point, as Bostrom states (Bostrom, 2016), it should be noted that it is not the same:

a) Accept the arbitrariness of a power strategy through a controlled technological entity (Centralized AI controlled by a power group).
b) Accept the arbitrariness of an autonomous technological entity (autonomous Centralized AI) or Singleton.
c) Accept the arbitrariness of all individuals through a decentralized technological tool (Decentralized Artificial Intelligence).

The model developed by the research and applied to a DAO (c) grants a large part of the validation methods to the human factor, control, and human responsibility (PoY), rather than relying solely on a machine (a), (b). This maintains the initial vision of the machine as a means to allow for a different social organization, avoiding arbitrary and harmful forms of power hindering individual and community progress (normative technological design process). In other words, the machine is responsible for distributing tasks based on the information of each individual by the Uill, and the Social Machine matrix where data from all individuals is computed. Human decision-making, control, and spirit remain intact, and only the medium becomes more transparent and direct, safe and controlled, configuring a chain of action composed of both human and machine domains. The machine domain is not above the human domain; they work together in a recursive relationship where each needs the other, a concatenation between human and machine domains.

The following sections describe the smart contracts that configure the dynamics of the organization and its processes. Smart contracts are grouped into categories corresponding to the families of tasks individuals perform: 1. propose, 2. delegate, 3. execute, 4. validate, 5. save or compute, and 6. finance. Each category comprises different variations of the same smart contract. Smart contracts use common labels to link nodes (individuals) and control interdependence and feedback within the machine domain.

14.3.1 Propose

This smart contract initiates the chain and is independent of whether the proposer is responsible for executing the proposal or not. The proposal smart contract consists of objectives, benefits, and cons (tags). If execution is involved, it also includes estimated execution time, the number of necessary tasks (cost), and the clauses of the execution. The proposal should include tags and consider the parameters used to validate the task's success, as they are key to validating the proper compliance of the smart contract execution.

14.3.2 Validate

This smart contract can be likened to a voting function applied to the proposed and executed smart contracts, and its output is a validation that activates another smart contract. The scheme is the same, regardless of the process being validated, and is composed of:

1. Labels (attributes Y_n), a metric from 0 to 10, ratio scale.
2. Variance statistic (S_2), the variance statistic is used because it achieves better consensus bounds; in addition, it is a very useful statistic for understanding priorities or prioritizing tasks.
3. Redundant system for granting legitimacy.

The validate smart contract is characterized by creating a redundant form that grants legitimacy since it uses the redundancy between the nodes that carry out the validation task (through their Y_n labels) to find a consensual evaluation. When there is a redundancy of evaluations, it is because there is no quorum. Explained in another way: five individuals (IDs), nodes with attributes (Y_n) must validate a proposal or an execution; three nodes validate >8, and two nodes validate <4. In this situation with such disparate valuations, the smart contract will look for another five id's with the same attributes (Y_n) so that they also validate, and thus compare the results, and see if: a) this same validation ratio is maintained in the same/different groups, or b) the resulting variance is sufficient to establish a validation.

If the non-consensus ratio is maintained, the labels are extended, allowing a higher node validation. In any case, the machine domain searches for labels that affect the evaluations of that id according to the progress output. Looks for the correspondence between the labels of the element to be validated and the labels of the individuals who validate.

The smart contract is fully customizable based on the specifics of the proposal or the type of execution. For instance, for amounts greater than (x) assets, the variation in valuations must exceed a threshold of (y). Alternatively, a proposal can proceed if there is a validation ratio greater than 2:3 during a specific time unit (t_1). If not, it will be rejected. Additionally, the transfer of assets is contingent on the validations during the execution.

Validation requires responsibility, which is an important element in giving legitimacy; whoever validates accepts responsibility for their assessment. To protect this legitimacy, redundancy in smart contracts is used. This ensures that whoever assesses will also be evaluated by other individuals with specific characteristics and attributes (Y_n labels). For instance, three individuals must validate whether a person is who he claims to be or validate a knowledge, statement or asset of that person. All three affirm that the person is who he says he is or has the knowledge. This is called a quorum (t_1). After some time (t_2), the smart contract poses the same problem to another individual. The system will not require redundant validation if this new individual reaches the same validation results. However, if the results differ, redundancy will be activated.

The assessment of those who value predicts the reliability of those who validate. This redundancy helps detect arbitrariness among the validators or within a whole group.

14.3.3 Execute

Following the logic described, the execute smart contract needs previous validations to be activated, and its product will be the input of the smart contract to validate as part of the chain. The smart contracts that make up this category must include attributes, times, tasks, task input (validated), task output (to be validated), and remuneration (asset transfers) according to the labels. This means the execute smart contract can have a finance smart contract related.

14.3.4 Delegate

The smart contracts that make up the delegation category allow validation tasks to be transferred to another Id with the labels that are deemed appropriate so that there is a transfer of responsibility, assets, and governance. Within a decentralized ecosystem, such as the one represented by the DAO, this smart contract allows forms of centralization within the ecosystem, halfway to the current dynamics. And if these have been included, it is also to facilitate the transition from a centralized model to a decentralized one.

The logic of this smart contract is that it copies the validation criteria of the others' Id tags. It can be exemplified as "What the id x values is what I value." Or, more precisely: "in environmental CSR aspects (Y_{CSR} labels), I value (vote) the same as id x (Y_{CSR} labels), and in economic aspects (Y_{ECN} labels), I value the same as id z (Y_{ECN} labels)." It can also be done in reverse; depending on the data of each one, it is delegated to someone who also has that data or that desired data. In addition, as will be observed later, the smart contract to delegate is the type of smart contract that allows an individual member of a DAO to be only a consumer who only wants a service and delegate the rest of the tasks. Or define much more accurate forms of representation.

14.3.5 Save/Compute

The save-and-compute smart contract enables decentralized processing and management of all tasks related to the machine domain. It allows an ID to have its data information decentralized among many IDs with high redundancy or perform social machine computing tasks. However, the energy the model requires is high, as all nodes must process and store information, because there is no central server to handle this workload.

14.3.6 Finance

This smart contract enables the bureaucratic dynamics of governance since it is one of the energetic elements of the system. It is described in the following section that refers to the DAO; the financing is open and democratic. Also, it can link validations with transfers.

14.4 Validation by Labels

Individuals generate a lot of information and labels that the machine domain uses to link different smart contracts between the different nodes. The validation characteristics are defined by the labels (Y_n), which determine how an individual evaluates proposals or executions based on their set of tags, knowledge, and attributes to evaluate (function a), and the labels (Y_n) of what must be validated (function β). Both functions (β_n) must match (ML categorization process) so that the individuals can evaluate or execute aspects they know[51] and delegate aspects they do not know through the smart contract to delegate.

So, whoever assesses a task has the knowledge to evaluate that task well. It can also be illustrated in the following way: "as DAO owner, I appreciate that x% of funds are allocated to develop a dApp that helps me to find a house based on my data and offers me recommendations based on it." Or "I can propose, assess and execute different aspects of this initiative, including financing it with x% of my assets, at an interest agreed by all of between I_x - I_y (%). But I cannot execute or validate the development of these tasks, because I do not have the necessary knowledge, or because I do not have time, or I just do not want." In this sentence, the set and sequence of smart contracts that the individual will require can be detected. If the individuals can detect which smart contracts they will need and how they should be concatenated, a neuronal scheme or deep learning should also be able to detect and concatenate them in a more complex way that our brains could never process.

The use of labels allows for structuring data, and smart contracts concatenate the sequence of actions according to this data. Basic machine learning (ML) techniques enable the improvement of organization autonomy, dynamics, and decision-making while enhancing legitimacy. In essence, a sequence of attributes or characteristics (X_n) configures certain labels (Y_n) based on their relationships, which can be expressed as a function (β_n). The relationships between the data contained in the "Uill" also configure labels. This same relationship can be reflected in a function, so each ID has its own function (β_n). Similarly, required proposals and tasks also have their function (β_n) based on their characteristics.

This solution enables the identification of the most suitable IDs for specific tasks, such as proposing, validating, delegating, executing, or financing. In other words, the problem to be solved, whether it requires validation or execution, consists of labels (Y_n) that establish relationships (β_n) among the problem's characteristics (X_n). The individuals tasked with solving the problem must have similar characteristics and labels that align with those of the problem. This means that when seeking a solution, the matching algorithm finds the optimal individuals to solve the problem according to its specific characteristics. The problem's (β_n) function must align with the function (β_n) of those solving it, or the function (β_n) must be composed of the set of

[51] That is why, in Fig. (x), the general/specific vote is shown as the instance of voting according to specific areas defined by the labels.

functions (β_n) of the individuals working on it. Matching algorithms rely on finding correlations and can even predict them over time, leading to the improvement of task groups or the concatenation of smart contracts based on the interdependency of the individuals.

The labels also allow agility when making assessments; for example, an individual's attributes (X_{in}) show that he values the investment of the DAO assets in environmental benefits. Individual label (Y_{in}) that refers to ecological aspects will condition the assessment of the smart contract, according to the label (Y_{in}) of the existing proposals. That same environmental label, applied to the smart contract to save data, can also condition to store the data of the Uill in individuals who produce their own energies. As pointed out in the smart contract delegate, labels open the doors to a much more specific level of representation for controlling contexts.

As we will see later, we generate a lot of data that explains much about us. It is important to understand that the labels generated come from people, whether individuals have assigned labels from themselves or by the machine domain generated. The machine domain looks for interdependencies resulting from conscious and unconscious human activity, thus forming a phenomenological model.

A matrix relates attributes (X), labels (Y), and functions (β) of individuals as the relationship between the attributes and the labels they generate. This study speculates that each individual generates different labels, some shared and others not, resulting in human diversity. By comparing the labels of all individuals longitudinally, trajectories can be established, and automated gates can activate other consensual smart contracts. For example, if the set of attributes generates labels categorized as "social urgency," the threshold function (gate) activates smart contracts to counteract it through policy implementation. If the data shows social urgency, the policy's correctness can also be shown after its execution.

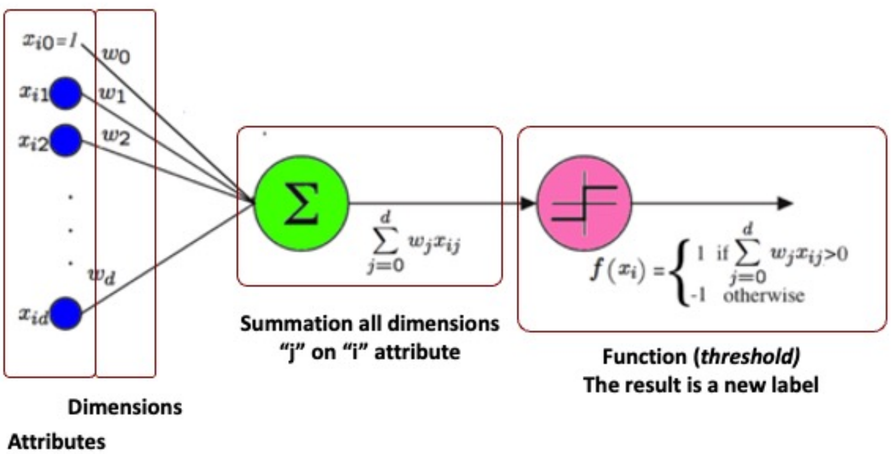

Figure 23. Perceptron algorithm. (Rosenblatt, 1958). Neural schemes allow grouping large amounts of data as attributes and establishing labels according to their relationship. An important aspect is that the threshold function

can not only activate a function or smart contract, but the result of the threshold application can configure a label or define the limits or values by which a smart contract is configured. Illustration (Mitchell, 1997) from edX AI.

The machine domain does not carry out the task; it does not make the decision; the human domain always carries out the task and makes a decision, and the machine domain provides the links to carry out the task, -which is part of the smart contract-. And it does this effectively by controlling interdependencies depending on the type of feedback.

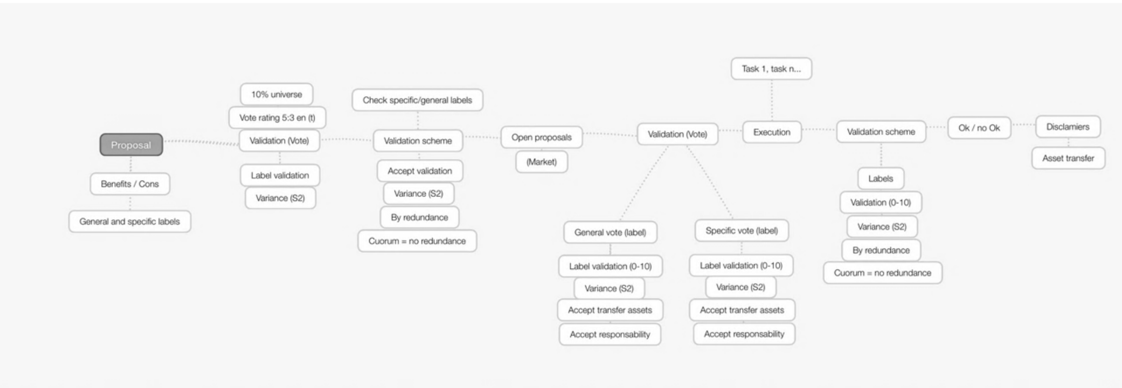

Figure 24. Basic smart contract sequence for coordinating tasks.

This bureaucracy dynamic can start an organization through its data and computing capacity by defining groups and relationships considering collective intelligence or social learning based on Fig. 10. It is essential to develop methods for capturing data and creating indicators that connect to the scheme shown in that schema, and debates are valuable spaces for generating information.

14.5 Debate Platform, the Space for Decision-Making

This scheme makes sense with the debate and the joint reflection, it is not only an atomized process through smart contracts but also a collective human validation. The discussion through a dialogic form is part of the methodological principles to cover complexity, the egalitarian dialogue between the diversity to cover different points of view. Promoting collective intelligence through opposing positions requires a space for dialogue, not an arena[52]. The machine domain can facilitate this by establishing relationships between labels to create groups, detect inferences and bias, classify information, and generate more data (labels). However, the machine domain cannot think for these groups. They need a space to come together and a tool that can help make collective decisions without interference from power.

[52] It's not an arena because it doesn't have the power or fighting component. The discipline of Law is based on struggle or conflict, the model tries to escalate this power paradigm.

This is why research take the example of Kialo.com: a platform with more than two million users generates and organizes debates of all kinds, with arguments for, against, implications, and consequences. The way the information is arranged and categorized, the trees of sets of arguments, and the assessments of individuals on these arguments allow decisions to be made from a much broader and objective perspective.

An individual may have an ideological position, but when evaluating arguments against that position, one can see that those arguments are also made up of other arguments, premises, or parts of that argument, which may conflict with other assumed values or agree with the opposite position, as seen previously in nationalism. The tool has many potentials, especially when the label manager is added and articulated through smart contracts. Thus, it becomes a discussion tool for common, binding, more effective, and efficient decision-making. What this research suggests is an example of an AI application in a discussion platform and an example of a dialogic process to reach a consensus.

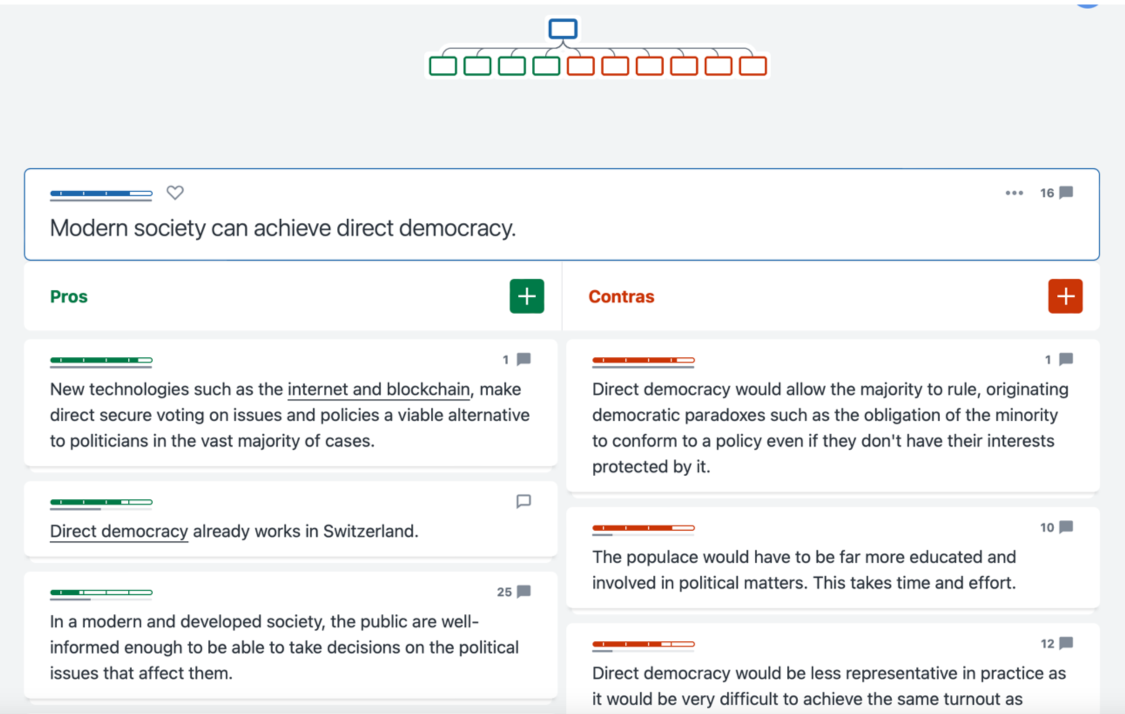

Figure 25. Screenshot of Kialo.com showing the basic information of a debate; in the upper part, one can see the tree of arguments for (green) and against (red). The argumentation tree expands if it clicks on the boxes that make it up, showing at the same time, at the bottom, the parts that make up those arguments in green and red as well. These also have more or less strength in the global, which is indicated in the upper left of each argument.

The researcher suggests that it is possible to extract relevant information from a debate and the labels generated by individuals in the discussion and their contributions using an NLP scheme and a ML label manager. The hybrid model could establish a decentralized regulatory framework in which individuals propose, validate, delegate, and execute actions in a consensual and coordinated manner, allowing for a more effective political process.

The example of Knack.it (now Knackapp.it) demonstrates how to set up discussion groups or task teams. The company is based on a methodology that creates work teams using game data. Each player or team member has a record of impatience, logic, perseverance, and other traits captured in different games. They each have a β function that relates to all their characteristics. The team also forms a β function. Thus, when hiring new talent, they find someone whose game results match the β of the group. This example opens a new world of finding new and diverse forms of organization. Especially when an ML process can predict how different people would fit into the same team or create chains of smart contracts (referring to the machine domain).

14.6 Examples Bureaucratic Dynamics Validation

Below are schematics showing the mechanics of a bureaucratic validation process:

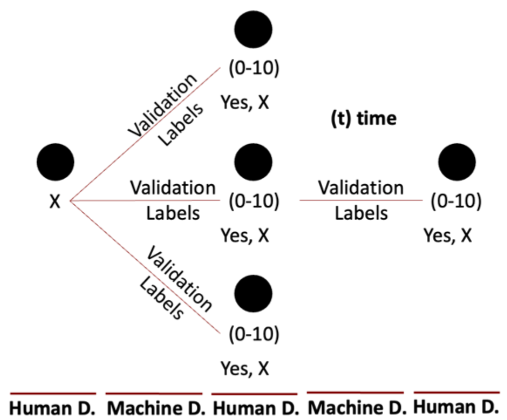

Figure 26. the most straightforward validation scheme is shown. First, the input from the human domain, a proposal, an execution, a problem, or a statement to validate (X). The machine domain, according to the attributes of (X) and the labels (Y) of this problem, establishes the necessary relationships to find the solution through the information of the Uill and the individual labels (Y) to detect the individuals who can answer/validate the problem (X). If there is a quorum in the first validations, it is efficient; if there is no quorum, the machine domain establishes new relationships to solve the problem. The category that defines the validate smart contract sets a time (t) to re-validate the question to another individual through their labels (Y). If there is a quorum, the bureaucratic process is effective and efficient and the tags of the individuals who validate are adjusted, and new ones are created.

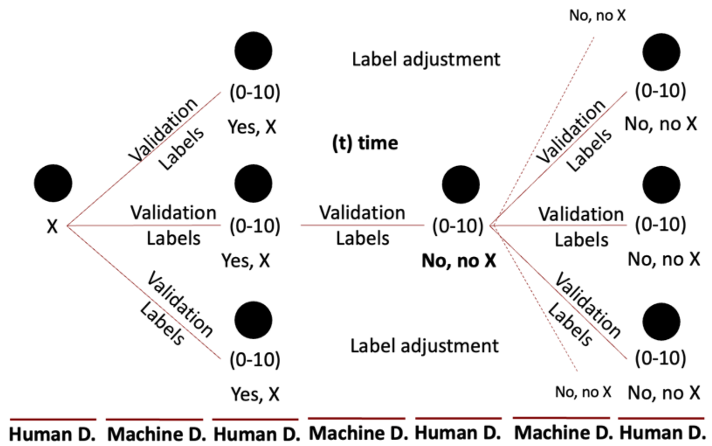

Figure 27. A more complex behavior is observed. The machine domain establishes three relations to solve the problem, and these three relations solve the problem efficiently. However, if at time (t_2) the machine domain asks another agent to validate the problem, and they solve it differently, there is no quorum. In this case, the machine domain establishes relationships between five agents labeled (Y) to validate the problem until there is a quorum defined. The labels (Y) of all the agents who have validated are adjusted.

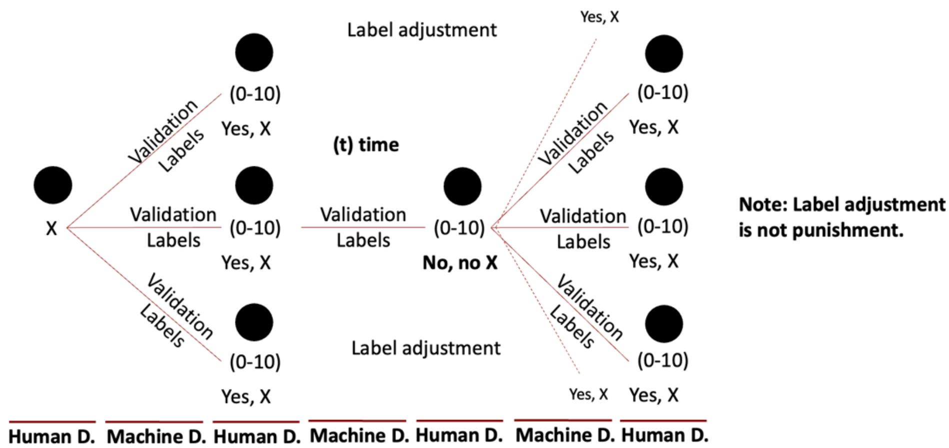

Figure 28. In this scheme, the label setting interprets individuality as a characteristic, not a punishment, as well as a necessary part of the quorum or consensus process. An individual may have a bias, a different assessment, or different characteristics. These are labels that the machine domain adjusts and creates.

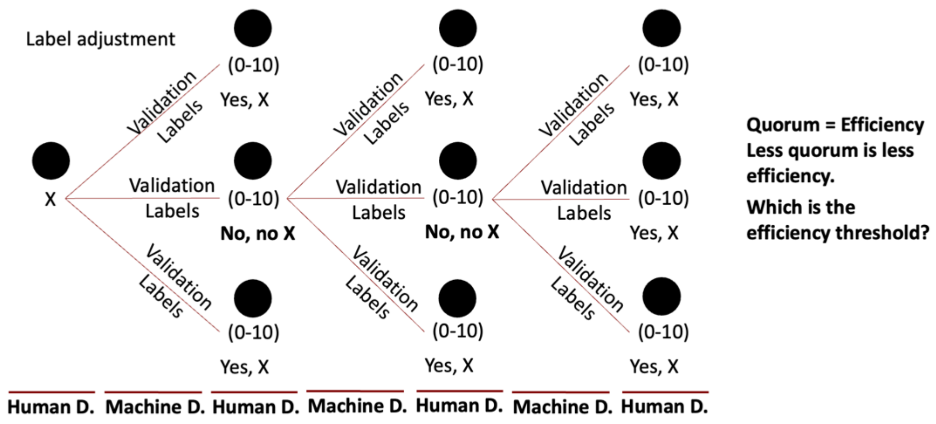

Figure 29. This schema a simplified process of voting. In a centralized scheme, only one agent performs validation, while in this case, there are many. The reliability of the labels and the resolution of the problems means that the machine domain can minimize the number of individuals involved in validation since the trust of the individuals It will be reflected in their data, and the machine domain will seek a quorum (efficiency).

15 Data Collection Module (the Uill)

The hybrid model of bureaucracy should encompass greater complexity by defining emergent bureaucracy and calculating interdependencies between individuals through smart contracts. However, in order to achieve this level of sophistication, it is necessary that the data of nodes be "complete". The previous section has focused on defining the control module and bureaucratic dynamics controlling the links between nodes; this section focuses on the node’s information, the model data, its capture, and the reason for its control. So, first, reference is made to the problem of data and its difficulty in regulating, conceptualizing, and designing later the solution following the previous premises of the model.

15.1 The Challenge of Data, Power, and Regulation

The previous dissertation (Huerva, 2018) discusses the digitalization process, exponential computing capabilities, the transformation of the network society, and the fact that various companies collect data on individuals. Many companies use advanced computing techniques based on big data volumes and AI to (e.g.) gather information on individuals and create effective advertising strategies. While the COVID-19 pandemic has led to an increase in the use of data technologies, the control of data remains primarily in the hands of corporations. China's "Social Credit System" is an exception, as the state controls data monopoly. In other parts of the world, corporations hold the power of data, which can influence people's thoughts, decisions, and even their votes. This centralized scheme puts the interests of those who control the data first.

15.1.1 First Perspective of the Problem

Being impervious to influence is challenging, especially in the era of fake news and infoxication, which has become increasingly prevalent in recent years. As noted in the first part of this dissertation, the democratization of content production has made it easier to create and disseminate false or uncontextualized information. It is, therefore, possible that a small group of interests, with capital invested in a specific sector, can use decontextualized and irrelevant information from experts outside that sector to influence their market. With minimal investment, blogs, influencers, YouTubers, or media agencies can disseminate biased information. Few win, and many lose, creating a negative feedback interdependence relationship. Those who lose may be unaware of the influence and feel bad about the loss.

This speculated context serves as an example of the inability of current regulations to keep up with new technological contexts. In the past, tools of influence were only accessible to a few very powerful entities. Nowadays, they are accessible to many more entities, not all of which are as powerful as those before. With more entities comes more influence, and individuals are now immersed in a greater amalgamation of influences and infoxication than in previous times. The question is, how can we regulate this? Content is an asset that is consumed and drives an industry, so regulating it would likely infringe on freedom of expression and struggle economy.

15.1.2 Second Perspective of the Problem

A more explicit and more non-speculative example is the case of the Cambridge Analytica consultancy (Gibney, 2018), which showed that data is no longer only used to design new products or services but rather to influence the vote in a way unthinkable until that moment (Ricoy-Casas, 2022). Traditionally, conservative political campaigns involved distributing leaflets near churches on Sundays. Nowadays, classification models show that these leaflets (e.g.) must be distributed in front of specific bars in industrial areas at specific hours or at metro exits at other specific times. The effectiveness of this method of influence can be improved by adapting the type of leaflet to the place where it is being distributed. When information from the internet and the OCEAN model is added, it becomes increasingly difficult to escape these new forms of influence, as everyone is susceptible to a greater or lesser extent.

As we discussed earlier, the binomial State and the markets create a power dynamic where those with more influence tend to come out on top. The Cambridge Analytica scandal raised concerns about this issue. If decisions are made under the influence of interests, it can be quickly inferred that a healthy democracy is not being applied, or at least not a "true" democracy. It is important to remember that for a good democracy to exist, precise information free from distortions and noise is needed, allowing for a common and correct decision-making process to face progress. According to the definition of progress in this dissertation, this means confronting new complexities without allowing entropy to absorb the system[53].

It should not be forgotten that the Cambridge Analytica scandal arose from an information leak that went public, but it was something that some of the regulators already knew about because they were already using it, perhaps not directly through that specific company, but probably through some of the competition. From the perspective of power that this dissertation shows, this generates a conflict; it is a difficult situation for politicians to regulate a tool that is precisely what allows them to win elections. This same perspective suggests that democracy is not given the necessary importance or is in lower positions on the agenda. Of the five countries with the right to veto, two are not democratic, and the quality of democracies is not the same in all countries defined as democratic; the agendas are structured based on the ability to influence.

From a perspective of technological obsolescence, of the obsolescence of regulatory tools, it can be inferred that democratic control organizations understand the action of Cambridge Analytica as a threat to democracy that forces rapid changes in legislation, the response to which corresponds to the RGPD 2018. The result of the Law is a form with subsections, tedious if one does not want to give the data to many companies, and with few guarantees of compliance. It is not an ideal solution.

When that news comes out to the public opinion, it is logical that regulatory institutions show a willingness to resolve or execute a solution; the action goes through a) solving the problem (perspective of social technologic obsolescence), they try to fix but they cannot, or, b) control public opinion (perspective of power), and in this sense, Noam Chomsky can be considered a contemporary benchmark. Regardless of the perspective taken, the result is the same, a regulation that does not affect this type of company, does not prevent political malpractice through the use of data, and a form that does not respond to the needs of society, such as the preservation of democracy and its freedoms. The threat to democracy is not minimized; the threat remains, and it is probably / possible to focus social attention on other aspects (agenda) rather than the actual concern.

And this is why the researcher suggests that the current framework regulation does not work. It is a sign that data technology has exceeded the capabilities and expectations that were held about them until now. The legislation has no way to control new technologies. Although very clear and forceful, the legislation cannot be applied; it cannot be executed because there is no tool to apply it, and no tool allows the exercise of the rights over the data. A law with a good liberal spirit but that does not serve its purpose, and that makes it difficult not only to browse the web but also to apply the law itself.

[53] As seen before with Polybius, partitocracy, oligarchy, and ochlocracy drive to entropy, and kingdom, dictatorship or emperor emerges as the solution of entropy.

The path that the dissertation follows suggests that is vital that the power of data must be in individuals. That individual must govern their data. Paul-Olivier Dehaye stated in 2018: ["The law is built so that this kind of investigation is possible. But the mechanics of it hasn't been smoothed out," he says. In his view, giving individuals better control of their data is a long-term solution to the ethical concerns thrown up by psycho-targeting methods"] (Gibney, 2018).

15.1.3 Third Perspective of the Problem

The video game "Detroit: Become Human" by Quantic Dream serves as an example of the third perspective on the data problem and the difficulty of regulation. The game is primarily a sociological game, presented through a cinematographic dynamic. It forces players to become politically aware and to have a sense of agency (Schubert, 2021). Throughout the entire game, players control three android characters in a world where humans treat androids as enslaved beings and commit atrocities against them, similar to the racial context in the United States during the last century. The androids begin to "diverge" and turn against injustice to demand freedom. It is not a fighting or platform play-game but a game of decisions with many alternative endings. It presents much more developed utilitarian situations than derailed trams and people tied up on the rail tracks.

The game uses three characters to analyze empathy (Holl & Melzer, 2022). The researcher thinks that data extracted from this game could show information about morality, impatience, stress levels, exploration capacity, level of violence, acceptance of inequality and injustice, or selfishness, among others could be measured. Game designers create scenarios where the players' ethics are the determining factor (Maisenhölder & Seng, 2019; Samuel & Schmiljun, 2021). The first character is an android who saves a child android from a violent-abusive human "father"; their goal is to flee the country together. The second character creates an android empowerment movement that leads to a revolution. The third character is a police android who works for the humans to nullify the androids that rebel.

Throughout the game, the player assumes opposite roles (police vs. revolutionary) and develops empathy for the characters (Craig et al., 2020). The player can kill or save the lives of other characters, lie, or tell the truth to them, and manipulate or be sincere to the masses. The game has many different trajectories and endings, ranging from the most peaceful without war, where all characters coexist harmoniously with humans, to the most catastrophic, with a thermonuclear war between humans and androids, resulting in everyone losing. The game can change completely depending on the player's decisions and actions. Choosing to create a peaceful demonstration is not the same as creating a violent demonstration to achieve the same pace objectives.

Moreover, this is where data is especially relevant, not only because it assesses the ability to make good decisions but also because it confirms much more information about individuals. The researcher has not played this game; but has followed various YouTubers and streamers as they played and made decisions in the game and wondered if, by crossing sociodemographic variables and the behavior of their habits, it could be predicted if that player will take one decision or another in that game. There are more than 6.5 million players (VGChartz, 2022); if these data are related to sociodemographics, habits, and cognitive data, it could explain more about the individual and society. What correlations exist between the sociodemographic parameters and the game sequence of decisions? Are there decisions and actions in the game that may be correlated with any sociodemographic or habit variable? Are there sequences of actions that correlate with the Gini index of the player's country? Are any action sequences in the game related to other types of content viewed by the individual? Through the situations posed by the game, the researcher has observed how the different streamers could reproduce injustice or inequality and wondered what cognitive and sociodemographic variables affect depending on what type of actions and decisions each takes.

It must be emphasized that it is a game; the game designer controls the context where the action takes place -and conditions the output-. In addition, it cannot be inferred that, in real life, that person acts the same, but the games provide much information about the individual. The data extracted in real life is reliable for predicting habits in the real world. The data from the game provides another dimension of information about the individual, perhaps more linked to the magic section. In any case, both compose information about the individual.

Through this example, the greater importance of individual data is shown, at the same time that it glimpses the problem of data in different aspects: The first is due to the value in data that the game generates and the power data have; in (WEF Whitepaper, 2021) it is observed how the value of the data is articulated. The value obtained from these data is so great that, for the researcher, the game is the least important thing; the data obtained from individuals are worth more than the game's development. A simplified business model could be: 1. Development of a video game, 2. With video game sales, development costs or benefits are obtained. 3. More benefits are obtained through the treatment and sale of data. And this is evidence of the problem of centralized power; concentrated data can be very perverse in just one hand's interests, and controlling social data enables one to control society.

This leads to the second aspect of the problem: Quantic Dream has been bought by Netease, one of the big Chinese tech companies. At the geopolitical level, the amount of information that can be obtained is huge. Comparing societies in this way opens new frontier knowledge for decision-making, especially if that country already has tools that extract much social information (such as the Social Credit App). Neither the supranational nor the geopolitical form is intended to regulate this complexity, either because of the internal complexity of the institution[54], which does not allow it to see this problem, or because, deep down, these are

[54] The internal power dynamics of the regulatory institution also cause that some bureaucrats, who can implement a solution are so focused on their personal ascension, that aspects that can divert their trajectory and generate shocks are dismissed.

aspects that require the agreement[55] of all the States. Agreements in geopolitical contexts are used as tools of power and can be difficult to reach and execute.

These three perspectives of the data problem show the lack of control or regulation and guide the solution's development. The research's logic understands that the individual's data is an asset given away when conditions are accepted in exchange for services. It is a very undervalued way of understanding the data as an asset because individual and social returns from data could be much greater. And the fact of being used only to design better products, games, and better movies; and not to search for new ways of designing policies, new ways of seeking consensus, or making better decisions shows that there is a long way to go.

As it has been seen, society defines the starting point of the social contract according to its expectations. Nowadays, we have tools to measure and capture diversity, define consensus and expectations more precisely, and define a new social contract. The research suggests that society must create tools that allow control over data; people must experience the benefits of data so that they want to be empowered through it. The study has not analyzed the profile of individuals currently sensitive to their data's privacy, the number of people who deactivate the privacy boxes whenever they browse, or if that number has been changing over time. ¿Is there a social resignation to surfing the internet constantly adjusting the privacy parameters? Regardless of the ideological conception that may be held, data should not be owned by a company nor by a State controlled by political interests. Individuals are owners of their data, and regardless of the position and interests behind them, individuals must freely decide what to do with them.

15.2 Conceptualization of the Tool

Data empowerment is an important element in the dissertation, not only because of the creation of labels for emerging dynamics or the ability to design policies accordingly. But also because of the problem of managing data without a centralized entity with more power than others to use them in its interests. The objective is to create a tool for the individual that allows:

- Manage the relationship with third parties regarding the use of individual data.
- The automatic exercise of individual data rights to erasure, data transmission, and anonymity is provided by law (RGDP 2018).
- Store individual own data safely and economically.
- Decision-making based on individual data.

The basic functionality consists of creating a legal AI algorithm (law bot) that captures all the individual's data, detects what data they are sending and where they are sending it, exercises

[55] In geopolitics, it is crucial to measure relations with China well; taking actions to regulate that a game's data is not used for geopolitical actions or hegemonic power would be very complex.

the rights over their data, and stores them in a safe and private decentralized network. This leads to the fact that the DAO is a decentralized social database, where all individuals are owners, and each uses them for their and the collective benefit.

15.3 Tool Design

The tool is designed through the following subsections.

15.3.1 Form of Organization: DAO

Due to the nature of the research, the design must be articulated through a Decentralized Autonomous Organization (DAO). In this form of organization, all members are owners of their data as well as the platform and can use the data for their own benefit. This solution is possible by a) Current technological possibilities. b) The need to respond to a form of equality and control by all nodes or individuals, which is an example of technological democratization over decisions and resources. c) A self-management tool for decisions about a common and individual good: the data.

How this DAO works must be understood as a form of technologically decentralized bureaucratic power, where the functions of control and responsibility that previously fell more "efficiently" in a single person are now decentralized, but with labeling technics (ML). There are no brokerages, there are no intermediaries; it is P2P managed by labels and ML techniques. As seen, the DAO is governed by smart contracts, which allow ways to calculate and manage information about assets, achieving new levels of self-organization and efficiency. It should be remembered that the objective is to try to convert diversity and individual action into an emerging system of multiple collective actions. In that way, smart contracts automate social processes that would be impossible for individuals to achieve on their own simply because of a matter of scale (information processing).

The model described below follows the logic of decentralized self-government based on the theoretical framework discussed previously. It defines the power scheme and the financing scheme and delves further into the validation and execution scheme (bureaucracy), which should allow its own dynamics and sustainability over time.

15.3.2 Ownership Scheme

The DAO is a matrix that manages assets (tasks, data, and capital) thru smart contracts. Each UILL comprises all the information of a person and cannot be transferred; an individual or an ID can only be one UILL. Each ID generates an absolute token and a proportional part of each type of asset; thus, in a scheme of ten IDs with four types of assets, they will generate fourteen tokens in total, and in a scheme of one thousand ID with four types of assets, one thousand four tokens in total. This token relationship ensures equal governance, regardless of the number of assets an ID has.

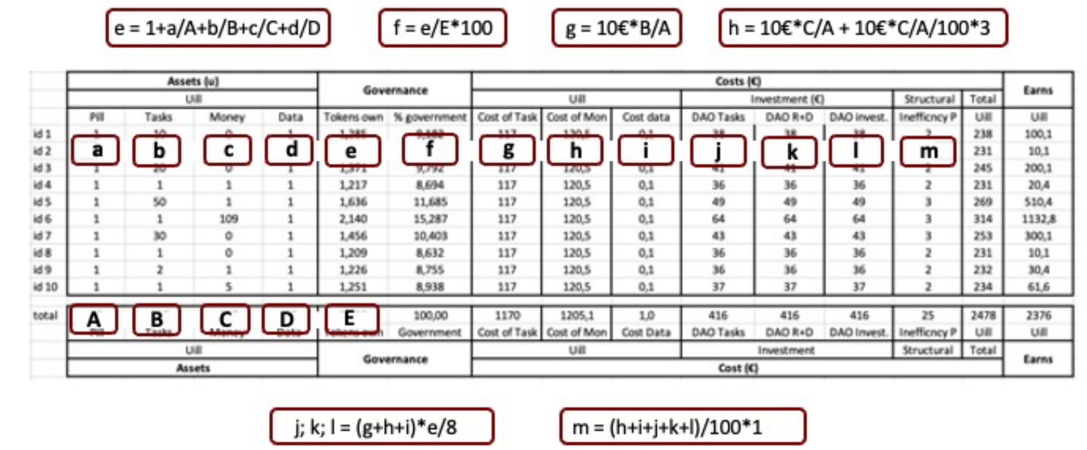

Figure 30. Scheme of the matrix that relates individuals, assets (left), government (mid-left), costs (mid-right), and earns (right). In this matrix example, unity of money and tasks is 10€. g; i ; j; k; and i values, are decided by all owners.

In the model defined by this work, "tokens[56]" are not exchanged, sold, lost, or earned; these simply represent the property of assets and express diversity. The tasks are the assets that the owner of the UILL can develop such as 1) creating a proposal, 2) validating, 3) delegating, 4) executing, 5) saving data/computing, and 6) financing. The last two are detailed properly in Fig. 30 as “money” and “data,” while the first four are simply “tasks”. These smart contracts or tasks have an associated cost (energy), which must be assumed by those who finance the tasks. Therefore, there must be a balance between the tasks to be carried out and the energy required to carry them out.

The organization's dynamics work in such a way that demand for financing is generated depending on the tasks to be carried out in a unit of time. This demand is then connected with the individuals who finance the tasks by means of `finance` smart contract.

15.3.3 Ownership Relationships

To ensure sustainable self-governance over time, it is essential to define economic self-management and how powers are established. The balance is achieved through three types of assets that make up the Uill: tasks, financing, and data. This configuration allows a balance to exist between the different interests of those who work, finance, or simply want a “service” through their data because regardless of the type of relationship they have with the DAO, they are all owners.

[56] The researcher must find another name for the word token that fits this scheme, the use of which does not strictly conform to token definition: “The purpose of a token is to allow access to a computer application (…). Tokens in dApps do not represent any underlying asset, they do not give rights to a dividend, and no equity is represented through them. Although the value of a dApp token may increase or decrease over time, tokens are not equity securities” (Johnston et al., 2014).

A constant of 1 per individual determines the distribution of ownership since no one can possess more than one UILL, just as no one can be two individuals or two longitudinal data trajectories; this equalizes the power between individuals. This constant dilutes power when more individuals join the DAO. Therefore, the distribution of property is calculated as the sum of all assets owned by each individual, divided by the total assets of all individuals for each type of asset: 1 (ID) + 1 (number of Uills / total Uills) + X_j (number of j assets / total j assets) + N_i (number of i assets / total i assets).

This distribution of ownership is reflected in how the tokens are distributed and how the power for decision-making is disposed of.

	Assets (u)				Governance	
	Pill					
	Pill	Tasks sold	Money sold	Data sold	Tokens own	% government
id 1	1	8	1	1	1,370	9,784
id 2	1	10	1	1	1,408	10,054
id 3	1	10	1	1	1,408	10,054
id 4	1	10	1	1	1,408	10,054
id 5	1	10	4	1	1,464	10,458
id 6	1	1	10	1	1,408	10,054
id 7	1	1	5	1	1,313	9,380
id 8	1	1	15	1	1,502	10,728
id 9	1	1	5	1	1,313	9,380
id 10	1	1	10	1	1,408	10,054
total	10	53	53	10	14,00	100,00
	Pill	tasks sold	Money Sold	Data sold	tokens	Government
	Pill				Governance	
	Assets					

28% resources
10% government

	Assets (u)				Governance	
	Pill					
	Pill	Tasks sold	Money sold	Data sold	Tokens own	% government
id 1	1	8	1	1	1,370	9,784
id 2	1	10	1	1	1,408	10,054
id 3	1	10	1	1	1,408	10,054
id 4	1	10	1	1	1,408	10,054
id 5	1	10	1	1	1,408	10,054
id 6	1	1	3	1	1,275	9,111
id 7	1	1	1	1	1,238	8,841
id 8	1	1	40	1	1,974	14,097
id 9	1	1	2	1	1,257	8,976
id 10	1	1	2	1	1,257	8,976
total	10	53	53	10	14,00	100,00
	Pill	tasks sold	Money Sold	Data sold	tokens	Government
	Pill				Governance	
	Assets					

70% resources
14% government

Figure 31. Example of DAO behavior in a buyout process. This is a process in which a minority buys and controls governance. The scenario on the left shows node id 8, with 15 units of money financed out of 53 units of money (28% financing), and obtains 10% governance. On the right, the same id has 40 units of money funded (75% funding) out of a total of 53 and obtains 14% of the power of governance. The power is diluted when a new individual is added to the scheme.

Individuals with consumer behavior will only run the smart contract delegate to obtain a service or product. In this way, smart contracts enable this kind of relationship without interfering with the owner-worker relationship. In other words, for a typical user who only wants a service for privacy, data security, or to take better decisions based on data, being part of a DAO should not differ from the relationship current users are used to having with a company today (delegation). They simply have a wider range of possibilities to relate, such as financing or working.

15.3.4 Asset and Cost Flow

The DAO as a form of organization requires a bureaucratic scheme composed of 5 initial smart contracts: propose, delegate, execute, validate, and finance, in order to function effectively. Tasks generate demand for money at an interest rate agreed upon by the form of government by all individuals. The final price of the UILL will depend on the sum of the interest rate and the cost of the entire bureaucratic apparatus (tasks) necessary to sustain the organization, as well as the investment required to sustain itself or its growth.

To determine the gross cost of a task, one needs to calculate the number of tasks required to run the DAO and divide it by the total number of UILLs. Based on this result, the task cost is established with the interest rate agreed upon by all owners (in the example shown in Fig. 30, the interest rate is set at 3%), and this defines the final price of the task. After the tasks have been executed, validated, and completed, the smart contract `finance` transfers funds between all the IDs in a peer-to-peer manner. All IDs can fund tasks.

Investment as an organization can be oriented in different ways; according to the example that the investigation follows, an investment is established in three aspects:

- DAO tasks are to maintain the bureaucratic regulatory apparatus for self-governance in the case of unforeseen events, additional forms of redundancy to validate that have yet to be contemplated in the forecasts, the ML process (the errors of the beginning), or failures not considered.
- DAO R+D to develop the scientific project that follows this research, expand and improve the tool, put it to the test, and for the development of tasks where the smart contract does not have a closed task compliance validation since it will be an error.
- DAO Invest, a monetary fund that can be used and decided by all owners, can be created as a fund for social proposals or new externalities.

The investment in the three parts is established by the sum of the pill costs of each individual, multiplied by the tokens that the individual owns, divided by an integer from 1 to 10 (K). The owners of the pill choose the said number (K). But its result can never be less than the forecasts on the redundancies necessary to find a consensus validation on the tasks to be carried out and their cost so that DAO tasks will define a minimum threshold.

15.3.5 Balance and Efficiency

From the schemes with 10, 60, and 1000 IDs, the researcher has observed that the power relationship in larger groups becomes a long tail; In other words, when there are few individuals, the differences in power and economics are greater, but when the number of individuals increases, the differences in both costs and governance are minimized, and homogeneity is created for all. This dilutes one of the main power problems, using the common institutional tool for purposes of individual power.

The DAO is designed so that data storage is also a task generator since if an individual has a stable, fast connection and free memory space, can store pieces of information from other UILLs. Thus, the entire network of pills is a server that presents more or less redundancy. In other words, a person's hard drive is also an asset; they can generate a profit by being part of this decentralized server infrastructure or their cell phone or computers. Decentralized cloud storage services already exist and are run by private; in this case, this DAO is a matrix of P2P assets, and the owner puts his assets to exercise a task in developing and improving the UILL, and saving and computing information, being part of the network infrastructure by itself, not by companies but from civil society. As seen before, intelligence in emergent systems comes from the base; there is no top-down or bottom-up in an emergent system since there are no tops and no downs. Civil society can develop an emergent system through a DAO without States or corporations and this reminds the researcher of Elinor Ostrom. From Civil Society to Civil Society.

It must be considered that a centralized administration requires a reasonable regulation of fiduciary duty, which is based on the duty of care, and the duty of loyalty, which are aspects that fall on the business administration and can generate conflicts of interest. In Kaal's analysis of DAOs, he specifies: "The autonomous decentralized nature of DAOs makes fiduciary concepts superfluous. The disciplining effect of fiduciary duties on management's conduct is less needed because centralized management is minimal in DAOs" (Kaal, 2020). In the model this research follows, all individuals are owners, workers, administrators, clients, and investors. As the DAO grows, centralization disappears, and the diversity of labels allows for the configuration of collective decision-making through the hybrid system. The larger the number of members and the diversity of these members -different and multiple labels-, the better performance of this DAO. And this creates a regulatory paradigm different from current legislation. Since responsibility is delegated by delegating decisions, there are decisions with a lot of responsibility that dynamically fall on a few people. According to the labels, the machine domain generates the necessary relationships (interdependences) between individuals. If the machine domain allows better relationships based on scientific indicators to make better decisions, it could grant a higher degree of legitimacy.

15.3.6 Tool Logic, Functionality

The tool is articulated through a dApp that is made up of the following:

a) A data aggregator, such a personal spyware, where all the data generated by each ID is monitored and stored from the cellular, the computer, and the IoT devices the individual owns. This creates the model "A."

b) A private login manager for trusted sites where data has been sent generates a request for the right of portability and, if desired, deletion; its result creates the model "B." It contemplates the entire relationship of data that is sent to third parties.

Model B completes model A, creating a data standard: the UILL, a unique and individual data chain with reliable data; its strength is the legitimacy of the data it composes[57].

c) A decentralized cookie manager that analyzes and controls the information sent to third parties. Allows individuals to use cookies from other members of the DAO. In other words, the information sent is a stereotype defined by all the information of those that make up the DAO. This is important, if the data does not conform to reality, it is useless and worthless. So this emancipates the population from the data market corporations and trespass the power.

d) A data manager, the tool must allow each individual to decide on redundancy. Depending on the result, the data is stored, between more or fewer nodes, in a more or less redundant way.

e) An interface that communicates the owner with the platform and allows the management of assets and tasks by configuring smart contracts.

The described logic serves two ambivalent functions: reliability and rupture. On the one hand, it creates a much more reliable, accurate, logical, and longitudinal data source, which is more valuable than the existing one. On the other hand, it separates itself from the current form of the data market because the data collected by companies that sell data -data brokers- do not conform to reality. Therefore, whoever generates the data takes control of the market and can define better lifestyle habits and policies and use the data for scientific purposes.

It must be said that, from the beginning of the conceptualization of the model, one of the great challenges has been the automation and management of communications for the application of data rights. The research solves this problem thanks to advances in NLP techniques and its latest generation (GPT-X), which allows individuals to communicate with data companies and thus exercise rights over them. A machine process between the individual and data companies.

[57] In Nairobi, the correct census is given by cellular use (Guillen, 2020).

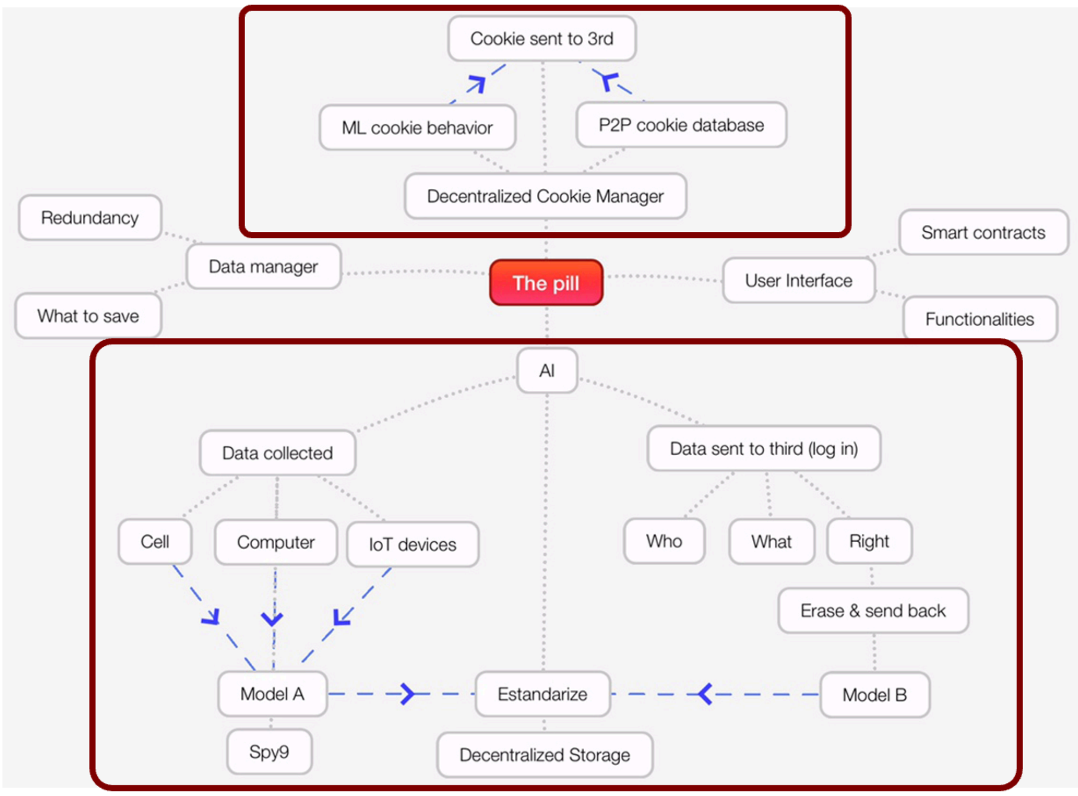

Figure 32. Diagram of operation of the data capture module. The top shows the breaking scheme, as it sends cookie information that does not match the individual. The lower part shows, on the one hand, the data aggregator, which creates model A, and on the other hand, the process of control and deletion of data that the individual disseminates, model B. Set A and B make up the unit of the Uill.

15.4 Summary of Tool Features

1) The tasks represent the human domain, define the organization through smart contracts, and are the link with the machine domain. 2) There is a balance between the tasks and the financing of these; this balance is a P2P relationship. 3) Reduces perversions of power; power is diluted as one more individual is added. 4) Power is focused on diversity and not on the number of assets; the diversity of assets tends to greater power. 5) Balance the value of work (tasks) and capital (financing). 6) All the owners validate the economic interest of the financing. 7) Follow an open model of mini jobs. 8) can be linked to a stable coin (crypto€).

The benefits it represents can be summarized as follows:

a) Use of technological resources for the spirit of the GDPR law; the project is protected as a competitive advantage (technology and social legitimacy) that helps to comply with the law. It does not go against it but complements it; where the law does not arrive, civil society comes with technology.

b) Use of data as a form of legitimacy since their reliability will grant legitimacy to the individual. As will be seen, the data shows much more information than what the individual interprets.
c) Social empowerment: the use of technology to preserve individual rights typical of liberalism, the benefits of using data for both individual and common benefit.
d) Economic empowerment: at the time of "colonialism" or the process of data monopolies currently being experienced, individuals are allowed to absorb the data market. The researcher infers that this model has similarities to a form of the gig economy (Guillen, 2020).
e) Align the interests of different individuals for the same purpose.
f) Establishes new efficiency standards that allow technological resources to create more autonomous management forms. Moreover, it makes it possible to redefine the primary function of the bureaucratic tool as a tool to control arbitrariness for the projection of society and not as a power tool subject to the interests of the person who holds it.
g) This part of the tool is oriented according to goals eight, nine, and twelve of the United Nations Sustainable Development.
h) It integrates with the current economic system and allows a transition to the new model (crypto€).

16 Social Machine

The UILL or Unique Information Library Ledge feeds all data to the social machine. The social machine is a data matrix that enables the design of personalized policies among all individuals. Everyone controls it through the DAO.

16.1 Introduction

The master's dissertation (Huerva, 2018) defines the first scheme of the data matrix; it breaks down into four dimensions: the physical field, the social field, the virtual field, and the emotional or cognitive field. This scheme had an error; the social dimension is not a different dimension from the rest; the social dimension is the set of dimensions of all individuals. Society is not an independent dimension but the aggregate of all dimensions.

Society is more than the sum of the individuals; society is according to how the individuals are and add up, according to how they add up their interdependencies and the feedback between them. The set of one type of label of an ID can indicate that the value of that set is 4. The set of that type of label of another ID can also suggest that the value of that set is 4. The result of the sum of these two individuals, the generated interdependence, will depend on the type of feedback between the two IDs. According to this, depending on the kind of relationship between these same IDs, this sum could be greater than the individual sum (positive feedback), with a result of i.e., 10, or also be negative; they are subtracted, with a result of 0. There are variables that affect the result of this feedback; trust, complementary skills, or empathy may be some examples that have been seen before, but there are many more that are unknown, but the researcher speculates that a label learning scheme (ML) can detect them (backpropagation techniques). In the relation (interdependency) between the two IDs in the previous example, when a third ID is added to that relationship with a different set of labels, it can reverse the sum, which is also why society is not linear. Society is more than the sum of its individuals because society is how they are summed, so it is not a dimension of independent analysis.

In such a way, the dimensions that capture the individual are 1) the physical dimension, 2) the virtual dimension, and 3) the cognitive dimension; these three dimensions constitute the information of an individual, the UILL. The social dimension is the aggregate of the interdependencies of all individuals. This scheme allows us to focus on analyzing habits and changes in habits.

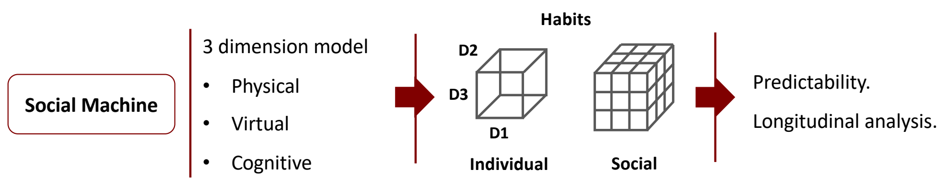

Figure 33. Scheme of the data matrix, the individual composes a three-dimensional model, and the society composes a three-dimensional model by adding individuals. The aggregate of individuals is not linear.

One dimension of the model explains a portion of information about the individual; the explanatory power increases as it is added and related to the other dimensions.

16.2 First Dimension: The Physical Context of the Individual.

The dissertation starts from the studies on mobility and GPS by Palmer and his team (Palmer et al., 2013), where they define the spaces of activity or activity zones and the changes in them that occur depending on the habits. From here, the researcher carried out a small test, following the GPS of seven people, defined typologies of spaces, and then made a hierarchy of those spaces according to the time spent in those spaces.

Through GPS tracking the activity radius of each individual, it is possible to determine whether a person has children, what type of work they do, what leisure activities they engage in, how they move, and which areas they frequent. These areas may include cold or hot spots, endogamous areas, ghettos, or other spaces linked between individuals due to shared labels (classification methods).

By comparing an individual's GPS activity with others, sociodemographic data such as socioeconomic status can be inferred. Each individual configures a set of spaces they frequent, ordered by the time spent in each one. For example, ID 1 may spend more time at 1. home, 2. office, 3. restaurant, 4. gym, 5. school… (X_n). If this individual quits their job (office disappears), there will be changes in their space hierarchy. The changes in space hierarchy for an individual living in a wealthy area (labels) who quit their job will be different from those for an individual (ID) living in a poor area (labels). So, it is not illogical to think that by comparing these changes with those of all other IDs who have quit their job, classified by labels, using statistical regression algorithms can predict changes in spaces. Depending on the labels maybe 3. restaurant disappears from the hierarchy of spaces of the example, but this can only be achieved if it can be compared with multiple IDs, and multiple groups of labels when the data DAO is huge.

The change in a habit leads to changes in other habits. These can be predicted if they are compared with other changes in habits that occurred in other individuals with determinate GPS space hierarchies and habits (labels). It could be expected what kind of habits change according to the tags if the GPS changes from "office" to "home" due to illness, job loss, or due the switch to a virtual job.

16.3 The Second Dimension: the Virtual Context of the Individual

In the data problem section, one can see how much information about an individual can be extracted from the virtual environment. Technologies that can handle large volumes of data, combined with data from social networks (such as Facebook), purchases, metadata, and ideological or political content, can reveal a lot of information about an individual's habits and personality traits (OCEAN); a kind of preferences can resemble a kind of habits, and these can be classified.

Just as the change in walking speed over the years can show the change in age, the difference in the scrolling speed, or the number of words read on the screen, can denote the use of glasses or complicated content -if it is a common habit of all those who read that content-, fatigue, or even age. These data have little information by themselves, but when crossed with other data, the information of the set increases.

Some researchers have analyzed Netflix (Fernández-Manzano et al., 2016) and its operating algorithm (Gómez-Uribe & Hunt, 2015). The data analyzed by the platform, according to Mohammad Sabah (Sabah, 2012) and Todd Yellin (Yellin, 2015) are: Type of content played or discarded, playback characteristics, "play controls," playback intensity, rating given by the user, recommended discarded content, type of device from which it is accessed, routes to access the content, location, day and time. Based on this, Netflix creates labels assigned to the content, on which the "personal video ranker" algorithm will work, which is fed by the data generated by the "taggers" or "labelers," together with an algorithm that considers internal factors such as the history of content consumption peaks or external factors such as Christmas or Valentine's Day.

"Any user action is captured, and a profile is created that matches some habits. These habits are fundamental to be able to compare the different users and to be able to predict and recommend optimally what their selection will be. And the "output" of this entire matrix becomes a recommendation system that represents 80% of the hours of video played by its users (Gómez-Uribe; Hunt, 2015)" (Huerva, 2018). The prediction methods have a lot of potential, especially when these can be related to social pressure. The master dissertation states: "(...) it can be extrapolated to the Netflix platform since it allows registration through the same user as Facebook. So if the recommendations come from trusted individuals like co-workers or like-minded friends, or if the same group of co-workers views the same content, the chances of more people in that group consuming that content will increase, at the same time that they generate social cohesion (Calvó-Armengol and Jackson 2010). When one agrees to join a network or see audiovisual content recommended by a friend, cohesion is generated; it is a way of socializing" (Huerva, 2018).

Consuming ideological content (labels) through an information channel (labels) does not necessarily mean that a person identifies with that ideology (labels). However, the probability of identification increases if the content viewed by their network aligns with that ideology (labels). Thus, if individuals within their network also consume that type of content (labels), it can be inferred with a higher degree of probability that the person is associated with that ideology. Finally, if that individual openly exhibits ideological behavior and shares content, it can be concluded that they identify with that ideology (Kristensen et al., 2017). The difference lies in the individual's predictive improvement as information is added and cross-referenced. Social motivations and other variables shape the belief and spread of (mis)information (Rathje, 2022); however, the research considers that in an influenced or coerced context, individuals would even share ideological content without believing in that ideology as well.

16.4 The Third Dimension, Cognitive Context

This dimension concerns what individuals experience in the other two dimensions. It aims to capture the cognitive scheme and understand social construction and richness. It has been many years since the first analyses of individual behavior data capture through sensors were conducted (Olguín, 2007; Olguín et al., 2009; Olguin & Pentland, 2010).

Bailey (Bailey, 2017) analyzed the use of Electro Dermal Activity (EDA) sensors, also known as galvanic response sensors, to find relationships with the human psyche. Various experiments have also been carried out using EDA sensors, these experiments correlate the occurrence of patterns (Grabska-Gradzińska & Argasiński, 2018), the placement of sensors in different locations (Cleland et al., 2013), as well as the measurement of stress levels (Pakarinen et al., 2016). Satisfactory results have been achieved when EDA sensors are combined with cardiovascular sensors (Lima et al., 2020). A recent article suggests that current artificial intelligence models for stress monitoring rely solely on cardiovascular sensors (Szakonyi et al., 2021). These models have become as reliable, if not more so, than those that use multiple sensors.

It is important the work of Fernández Aguilar and his team, who, using an EDA sensor and a cardiovascular sensor, achieve a good predictability of seven emotions: Affection >82%; Entertainment >87%; Anger 82%; Disgust >85%; Fear >84%; Sadness >85% and Neutral with a prediction >68% (Fernández-Aguilar et al., 2019). The researcher speculates that when these emotional states are added to the other two dimensions, a world opens up to understand the individual with much greater complexity and diversity. Patterns of space are understood, virtual patterns are understood, and emotional patterns are understood. And not by each dimension but through the relationships between these three dimensions.

Whether it applies to a game like Detroit: Become Human or to real life, analyzing stress levels based on location, activity, and company can lead to a greater understanding of both individuals and society. Understanding the emotional state in each dimension provides invaluable information, as it allows for a deeper insight into the extent of human experience, the interpretation of common situations, and the understanding of reality. And it is here where the analysis of how the individual shapes his social construction, the individual and social frames, makes more sense. It opens the door to understanding what can be classified as "good" for a cognitive system, for another can be classified as "bad" or indifferent, or the processes of change between classifications, or the ways to normalize attitudes and consolidate them. Understanding the different cognitive schemes (individuals) that make up society is vital to organizing collective action, defining better policies, and developing an emerging action that can encompass greater complexity.

Currently, the devices that monitor the individual have multiplied; in the summer of 2020, the researcher tried Oura, a ring that monitors sleep, activity, heart rate, or blood oxygen. The latest version has a temperature sensor that allows detection, from when one is about to catch a cold to predicting menstruation. A product with a learning period of twenty days, elitist, and that works through a subscription. The price of these devices is falling, and it remains the same in others. In 2017 in the final degree project, there was only one watch to measure EDA, called Empatica E4, and it cost more than €1,000. Currently, Fitbit already has models with EDA for €300. Apple, for its part, has not launched its latest model with EDA but with better cardiovascular monitoring capabilities (2021); being able to detect stressful situations is a first step.

Figure 34. Physical, virtual, and social states can be correlated with emotions. Using a backpropagation algorithm, predicting a person's mood should be possible based on their surroundings, activity, habits, or who they are with. This way, it could show whether a person experiences more stress at home than when outside or if their stress levels change when interacting with individuals who share (or do not) specific labels.

Through these three dimensions, the Social Machine can calculate all the possibilities of interdependence and the positive or negative feedback of the relationship between IDs. In other words, the matrix must make it possible to predict the synergies between individuals; it calculates the synergies between people and can create teams according to the requirements of the smart contracts through the labels that their data generates.

If Elster's analysis of rationality is considered, he classifies emotions into three large groups: "A) Evaluative emotions (shame, anger, pleasure, pride, gratitude, and admiration). B) Emotions generated by the possession of others (envy, sympathy, compassion, resentment). C) Positive or negative emotions generated by the good or bad that happens to the agent (joy and sorrow) or by good or bad things that may prevail in the present (love and jealousy)" (Vázquez, 2016). Shame, anger, joy, or love could be inferred through the data of the three dimensions. Alex Pentland mentions experiments that, using people's audio recorders, could classify moods according to voice timbre and the type of email by the sound of the keys without knowing the content of said email (Pentland, 2015).

16.5 Application of Learning Systems

In this dissertation, reference has been made to the elements that affect social pressure, social learning, trust, or collective intelligence; it is observed that multiple factors are related. A relationship diagram of these concepts has been shown in Fig. 10. It has also been pointed out how to capture them, creating a description of the individual based on the relationship of these elements. This relationship cannot be inferred to be the same for other individuals; each individual is different, and the relationships between these elements and their values may differ. For example, the values of the labels "awards" or "cohesion" and their relationship with social pressure may differ depending on the person and their cognitive trajectory. If data is correctly captured, it can be inferred that there are relationships between characteristics (x) that generate some labels (y) and can be expressed by function (β).

The thesis proposes to identify the labels through the perceptron algorithms (Rosenblatt, 1958), which are part of the neural network technique (Fig. 35) and have mimicked a brain. As the dissertation points out, various cognitive scientists conjecture whether brains incorporate Bayesian algorithms (Marcus & Davis, 2013) in the way they perceive, deliberate, and decide; and, at the same time, they open the discussion on to what extent the cognitive scheme of an individual is Bayesian (Bain, 2016; Sanborn & Chater, 2016). The researcher speculates that the scheme that relates the concepts seen in the cognition section (Fig. 10), which distinguishes and identifies each individual, can be obtained through backpropagation techniques (Fig. 35). Techniques such as the Restricted Boltzmann Machine or Convolutional Neural Networks (CNNs) can identify the schema of social concepts more precisely and individually.

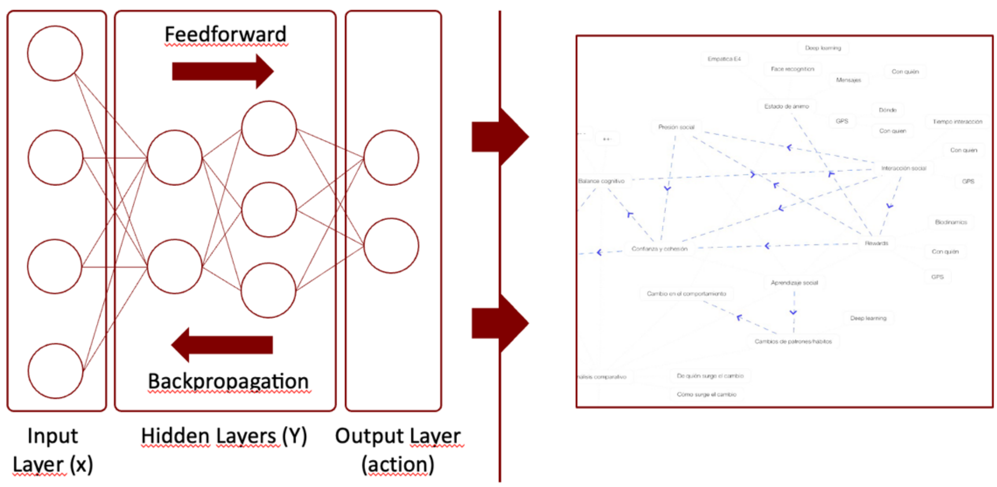

Figure 35. Operation of a Backpropagation scheme, the data obtained from individuals (input layer), a transformation process (hidden layer), and an output layer corresponding to human action. The capacity to capture data from input and output layers by means of the three-dimensional model should be able to define the weights and the scheme of relationships between the elements that define individual and social dynamics seen before (Fig. 10). This type of algorithm can define the elements (transformation) that affect between the input and the output.

These autonomous learning models are robust, especially when the final labels or output (supervised learning) are known. The logic proposed by this work suggests that if the input and output data are obtained through this three-dimensional model, the elements that relate the input and output can be identified. The individual's action (output) determines whether or not the autonomous learning process is correct, as it confirms the prediction. The neural algorithms define a scheme of variable relationships (Fig. 10) and make predictions about the hidden relationships (hidden layers). The forecast is evaluated when these predictions are compared with the actual labels (human action). If it is incorrect, the algorithm checks the schema backward (backpropagation) and readjusts the weight of the relationships to fit the actual label. This is an essential process for understanding data training methods.

Applying these algorithms in the model this research follows defines it as a phenomenological model and improves over time as there is more action. Taking the magnitude of longitudinal data through the three dimensions, labels can be established for social concepts, such as cohesion, social pressure, trust, reward, or punishment; and locate the values and relationships of these elements that could predict action. Each individual is different, and each scheme between labels is almost unique; although many configurations between these elements could be the same or shared among individuals, some configurations are different; it is human diversity.

The strength of the model lies in its comparison of the backpropagation schemes of different individuals and its analysis of how labels are configured, changed, and consolidated over time. This allows patterns and common elements to be extracted. Furthermore, not only trajectories can be detected and predicted, but changes can also be predicted. By analyzing data obtained through current classification methods, it can be possible to create a dichotomous scheme similar to the one proposed by Kahneman (system 1 / system 2) or to define what constitutes a game, a party, or a sacred element, as proposed by Huizinga previously seen as the process and dynamics. In this way, an individual can be seen as composed of multiple games, and the labels of those games can be compared. These data perspectives could provide new information on social symbols and help broadly understand individuals and their relationships with others. This process is essential for identifying the elements that affect synergies and the different feedback between individuals.

These data perspectives could provide new information about social symbols and help understand the individual and their relationship with the rest in a much broader way. And it is essential to identify the elements that affect synergies and the different feedback between individuals. This way of analysis allows each individual to be identified based on the set of their data and the relationships with the data of other individuals, showing a new way of understanding the individual's identity. An individual comprises matrices of attributes, characteristics, and data. The relationships between these data make up labels, the relationships between data are expressed by functions, and the set of functions can also be classified as labels. And those labels are compared between all IDs to extract common and diverse information, to compare diversities and extract common patterns.

16.6 Policy Design, Predictive Policy

As far as has been seen, one definition of politics could be the industry of the organization of formal power, which also has a behavior that the researcher speculates that Game Theory could explain better. The perspective on which the dissertation runs understands that systems organize energy and resources according to their characteristics through transformation and feedback processes. In centralized systems, this process occurs in the higher nodes that distribute energy to the set of nodes that make up the network, a top-down action in such a way that the lower nodes grant energy or resources to the superior nodes. These redistribute them to the rest of the network; a centralized, hierarchical redistribution always creates a dependency from the upper nodes.

The conception and architecture of an emergent model do not allow for this approach. In this model, the nodes self-organize and self-design policies, carrying out energy transfers between them to cover a greater context and complexity. The researcher considers this process as a pre-distribution of network resources. Moving from a distributive model based on redistribution (centralized) to pre-distribution (decentralized) is a paradigm shift. However, the existence of pre-distributive behavior implies that the system can be predictive. Inferring that the machine domain can predict individual and group behaviors based on comparing trajectories, labels, and common and differentiating elements has always been met with skepticism in research. As research has progressed, it becomes more apparent that the model can make individual and social predictability more plausible than Facebook likes (Kosinski et al., 2013).

Before learning about the operation of some AI techniques (Russell & Norvig, 2010), the researcher believed that using individual data could detect situations of social urgency that currently go unnoticed. For example, if data shows that in one month period, an 80-year-old person (x_{ia}) has only had social interaction with three people (x_{ip}), does not move more than 50m from their home (x_{is}), and has no virtual interaction with others (x_{iv}), this data set could be a signal of social urgency. When the existing relationship of these four attributes (β_{il}) defines labels of social urgency (y_{isu}), a gate can activate a sequence of smart contracts (e.g.) `proposal` or `execute` through the relationships between tags (y_{in}) of other individuals to revert or minimize the social urgency, to change that individual's data. But as seen in the previous section, longitudinal data project trajectories not only can be detected but can also be predicted (Rovira et al., 2017). If the cybernetic scheme (Fig. 12) is kept in mind, the transformation is the relationship between the input and output of the data. Likewise, the relationship between the output and the input is the feedback.

Open systems change and adapt through the process of transformation and feedback. In this sense, the definition of politics in this dissertation is delimited by the control of the human system's transformation and feedback processes. So, the design of the political form of the model focuses on the use of technology to facilitate the processes of transformation and feedback, following the principles of an emergent system described previously. So, the research infers that if the data shows a social urgency, it must also indicate a change or a correction after applying the policy (transformation process and feedback). And also, if the policy is well designed (controlled and without distortions), the output and input data will be mostly as expected or predicted. Suppose the input and output data are captured through the three-dimensional model and stored in the UILL. In that case, the social machine establishes the relationships between the nodes so that the transformation and feedback processes are consistent with those expected in the inputs and outputs to build the smart contract sequence. In such a way, the machine domain creates the links between the individuals so that the transformation and feedback process is consistent with the input and output data.

The model is conceptualized to make possible to capture and know which elements affect the sequences of habits, which is more likely to trigger different trajectories (such as the example of the game Detroit became human but in the "real" world). As mentioned, the hybrid form allows the concatenation of tasks through the control (prediction) of feedback, synergies, cooperation, collective intelligence, or dialogical principles according to outputs. The three-dimensional model approach can capture the data to accomplish this, and the machine domain establishes the links between individuals based on their data and labels, seeking equality, freedoms, heterogeneity, and consensus to achieve that output.

To govern systems, laws of thermodynamics should be considered; transformation and feedback processes require energy, information, assets, and resources. The DAO and smart contracts control this process by minimizing distortion (power) and fostering consensus. This framework establishes an emergent, decentralized, and assembly-based political form. If we take into consideration the scheme that includes data (X), with relations between them, labels (Y) and that can be represented by a function (β) (Fig. 36), this scheme can explain not only an individual, a product, or a film series can also explain a political party, relationships between resources and individuals, or relationships between individuals.

$$\underbrace{X := \begin{pmatrix} 1 & x_{11} & \cdots & x_{1j} & \cdots & x_{1d} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ 1 & x_{i1} & \cdots & x_{ij} & \cdots & x_{id} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ 1 & x_{n1} & \cdots & x_{nj} & \cdots & x_{nd} \end{pmatrix}}_{\textbf{Attributes}} \qquad \underbrace{y := \begin{pmatrix} y_1 \\ \vdots \\ y_i \\ \vdots \\ y_n \end{pmatrix}}_{\textbf{Labels}} \qquad \underbrace{\beta := \begin{pmatrix} \beta_0 \\ \vdots \\ \beta_j \\ \vdots \\ \beta_d \end{pmatrix}}_{\textbf{Function}}$$

Figure 36. Relationship between attributes, labels, and function. This relationship is essential for categorize or matching algorithms. This scheme can be applied to an individual, a political party, a product, or a series.

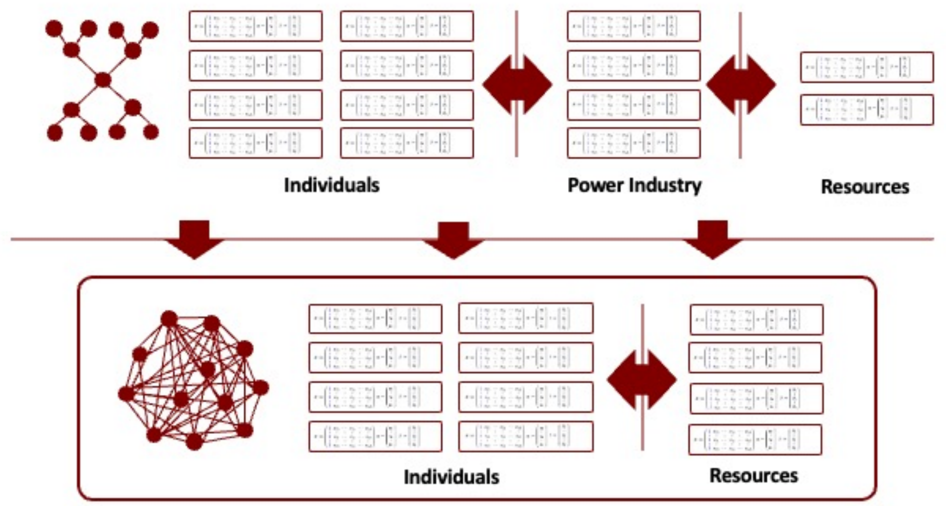

Figure 37. In the upper part, it can be observed that the scheme of the current situation follows a centralized diagram of representation, where the set of individuals, attributes, and functions "adjust" to a party system scheme with its own attributes, labels, and relationships between them; and resources and society is organized, which has characteristics, and relationships between these characteristics that functions can represent. The political structure adjusts (intermediates) the functions of individuals to the functions of resources and society. In the lower part, the model suggested by the thesis is observed; it is a direct process, the functions of individuals adjust to the functions of physical and social resources, and there is no intermediary. It can also be seen that in the scheme, the resources increase; it is not that the model multiplies the resources but that the model brings out more resources (social) that the current political and economic structures do not contemplate. Note: Power industry reflects parties and oligarchies.

Fig. 37 shows the difference through which the model's logic runs, the current political form channels the process of transformation and feedback, and manages energy, resources, and information. The research suggests that political parties are functions that mediate between the functions of individuals and the functions of resources; these functions should be "neutral," representative[58], transparent, without their own interest of power. In the model proposed by this research, this intermediary function does not exist; it is a direct relationship between the individuals' functions (β_i) and the resources' functions (β_r). The transformation processes fall into the machine domain, in this sense, the model should be effective and efficient since there are no distortions between object and subject; it does not have its own intentionality nor its own interest. It does not generate distortion of power, just interdependencies based on ML labels to reach consensus and agreements. There is no tendency for monopoly or oligarchy, regulation is decentralized, and as has been seen, greater control of resources by society is equivalent to greater efficiency in distributing system resources. This is equivalent to more efficient system regulation and, therefore, less inequality.

The ability to predict input or output data through a transformation or feedback mechanism opens the door to the concept of predictive politics. In this context, the researcher

[58] As previously stated, the perspective of power influences that the behavior of this function is not like the sum of individuals; it has its own function.

has analyzed the concept of futarchy, which was devised by Robin Hanson (Hanson, 2013), and was also developed and enabled for implementation by Vitalik Buterin, the Ethereum ideologue. Buterin highlights that futarchy solves two problems: a) voter apathy or the lack of incentives to vote, and b) the problem of the irrational rationality of democracy (Buterin, 2014). The researcher is aware of the Gnosis[59] community, which is developing a DAO based on futarchy principles. However, as the researcher is not a part of this community, a detailed assessment cannot be made. Marcella Atzori defines futarchy (Atzori, 2015), and Garrod refers to this term when describing new corporate forms as decentralized autonomous entities that use a combination of futarchy and liquid democracy to determine how the company should spend assets each day. (Garrod, 2016). Hanson describes it in such a way that when a betting market estimates that a proposal increases national welfare, that proposal becomes law (Hanson, 2013).

The theoretical trajectory followed by the research, and the predictability that defines the developed data model, are distinct from futarchy. The model that the thesis defends is not a market prediction model because societies are more than markets[60]. Futarchy is based on market predictions based on zero-sum games (Zamfir, 2017). However, societies and individuals are more than just zero-sum games. The model allows flourishing new individual assets (social capital) in a way rather add to and complements each other. It basically focuses on the control (prediction) of the transformation and feedback processes, establishing relationships between people (sets of labels) to find consensus and collective action (progress). The amount of information the model should handle through the three dimensions measures people, trajectories, relationships between them, measures society, and interdependencies between people are not only based on market metrics.

16.7 Reflection

The model arising from this research proposes a process of transformation and feedback, following an EPP (see Emergent Political Process: Tarrow, 1994; McAdam et al., 2001; McAdam & Tarrow, 2018) by controlling the links, allowing for development according to the definition of progress (equality, freedom, ratio diversity and consensus). The human data capturing proposal can bring out "new" social resources and social assets (see social capital: Helliwell & Putnam, 2004), new metrics, emphasizing that social capital is an asset that can be more valuable than money.

The transformation and feedback processes are controlled by predicting the labels that make up the relationships (interdependencies) between individuals, and that affects the output. The prediction allows the control of the concatenation of tasks and smart contracts; the model

[59] www.gnosis.io

[60] In (Hanson, 2006), the conception of a political definition based on markets is observed, extrapolating the dynamics of the market to the rest of society. As defined (Fiske, 1992), the market form is, to a greater or lesser degree, one of the relationship elements, but there are more, and they can be combined.

should be able to predict them, motivating the bureaucratic[61] processes to be dynamic and open to casuistry or problem-solving. Since the model can relate individuals according to their labels, it defines an ad-hoc bureaucratic process to the problem and a personalized policy to the casuistry of each individual.

As previously seen, the personalized politics tailored to the individual follows the same logic that companies use to design products, songs, series, and other content tailored to the individual but with a much higher level of information. This decentralized model does not mean that an entity defines policy through an individual's data[62], but rather that all individuals design policies through their data. The machine domain seeks to identify common labels and between all individual data to define policies.

The machine domain does not have human intentionality or instinct preservation; it has the same interest in its benefit as a calculator. It is not an entity with consciousness but the aggregate of all individuals through their AIs, owned by each and controlled by all. There is no AI above the rest. The AI of an individual should be able to make the interests of the individual prevail even better than the individual himself in the face of risk, uncertainty, and complexity. Even the sum of all individuals' AI to compose the machine domain could not prevail over the human domain, one requires the other; it is a recursive relationship between domains. The model converges to the methodological principles of this dissertation: 1) Dialogical principle, where opposite and complementary approaches converge. 2) Recursive principle or feedback, where the effect influences the cause. 3) Hologrammatic principle: where the part is in the whole, and the whole is in the part.

The centralized power conception is an element that will inherently threaten democracy since it can even be used for its own interests. While democracy is centralized to make it applicable and representative, its true potential is achieved through a decentralized structure. The trend toward democratization suggests that the best way to control power is to decentralize it. Emancipatory technologies have already demonstrated the ability to empower society and decentralize power; therefore, the path to democracy lies in decentralization. The model analyzed in this document takes a step towards decentralization, promoting social empowerment in politics and maintaining a degree of centrality through smart contract `delegate`.

The hybrid model should be able to define new frontiers of democracy since it transitions from a centralized democracy framework to a decentralized democracy framework. This framework does not follow a left or right axis; it does not follow a socialist or liberal axis. It has already been seen that the ability to generate wealth and progress in a country does not depend on the ideological classification of that country but rather on the capacity of control that society has over the institutions that manage the resources of that country. Delimiting a gradient from

[61] Made up of individual tasks.
[62] No es que Netflix diseñe una serie acorde a los datos del individuo, es que el individuo diseña una serie acorde a sus propios datos.

authoritarian regimes that allow less control to highly democratic regimes that allow more control, the latter being the ones that will be able to maximize the wealth of those resources so that they will be better governed. The researcher interprets this gradient as a degree of governance quality, democratic quality, greater democratic development, and greater capacity for progress.

17. Execution of the Model

Once the model has been devised, the study must find a way to specify all this information to be assimilated, executable, and experimented with.

17.1 Current Situation: The Drift of Blockchain

In this section, the researcher analyzes the creation of a DAO (Reyes, 2019). When writing this dissertation, only Luxembourg and Malta among the 27 countries that make up the European Economic Community can register DAOs. Current legislation does not permit a person to have different relationships with the same organization; it is a question of legal responsibility (Bilic, 2021; Kaal, 2021). Clients or workers cannot also be administrators of the companies. This is not even contemplated, and it would not be operational if a notary did not legitimize it in most EU countries. Nor is it feasible for a bank to register an entire community of people in the same account. Such a way of regulation does not even exist (Riva, 2020; Community Paper WEF, 2021). However, paradoxically, with a little bit of ETH, creating a DAO has never been so easy.

Investing in markets required high capital; it was not something that was within everyone's reach. With crypto assets, there are no limitations, barriers, controls, or regulations; this is a perfect breeding ground for opportunism. The researcher started to learn about Bitcoin more than a decade ago and has observed different stages of the development of the applications since then. The initial stage may be the most "romantic" time in cryptocurrency investment. At this point, the value of coins was very low, making it easy to make money. Any crypto asset was likely to increase in value, and even with small investments, high returns could be achieved without much knowledge or effort. Although there may be volatility, the value typically mostly went up as new agents were added to the market. Many young people, not just wealthy individuals, have invested in these assets and may suddenly find themselves with returns of several thousand percent. This is when the first cryptocurrency powers are created.

The second stage, according to the researcher, begins with confinement. It is assumed that due to the idleness of individuals, the time they spend at home, the performance of crypto assets, the rise of Non-Fungible Tokens (NFTs), the ease of creating coins, and the Initial Coin Offering (ICO) en masse, there is a confluence of different factors that causes an explosion and significant increases. Although there was a great "cataclysm" with the ban on Bitcoin in China, it was the practical explosion of decentralized finance (DeFi), and "anyone" with an idea, a White paper, and creating a currency could easily access financing. As in the first phase, big technology companies invested little. In this second phase, big technology funds began to enter more strongly, and fighting game communities were consolidated, where whoever loses pays the winner. This had different consequences, from people in Venezuela who earned a lot of money playing video games (MLN)[63] to people who invested the money they received from pandemic subsidies.

The third stage is characterized by the evidence that technology does not fail, people fail, centralized organizations that must attest to the value of a currency fail, causing the great falls of stablecoins, and show opportunism, the fraud for the non-regulation, Ponzi pyramid schemes, false promises, "pump & down" scams, "zombie coins[64]." Power interests use crypto discourse as rhetoric for their own benefit, causing thousands of people to lose money. As well as currencies that are nothing, they have nothing solid behind them, not even a White paper or a concept, but they spend money on advertising so that people invest in their currency, being a sample of a new "business model." Ultimately, investing in a "doggie" currency (i.e.) in which millions of people have invested billions of dollars, does it only have economic value? What additional information shows us that millions of people are investing billions of dollars in these new currencies?

Brands also invest large sums of money to over-value their product; the business model described is not far from it; it is the same practice, but at least there is a product or service. The consideration of the crypto "doggies" is that their value will increase as long as there are individuals who continue buying "doggies," and there are companies that follow a centralized scheme that creates advertising campaigns and energizes the "doggies." However, as soon as the company stops disseminating information to encourage their purchase, creating content about this "doggie" or people stop buying crypto "doggies," their value will fall. It is logical for markets to fall when people stop buying; this is not something that only happens in the crypto world. If the company that carries out the dissemination campaigns for the "doggies" brand also buys and sells "doggies" depending on whether their value increases or decreases, it can be better understood that they have formed large concentrations of money.

Some companies and corporations operate in decentralized environments without regulation and exploit this loophole. Events, such as the crashes of "stable coins" like Luna and Terra, or the crash of the Exchange FTX, show that it is not the technology itself that is malfunctioning but rather human error, which creates a problem of trust. Whether the company is an exchange, an auditor of a stable coin, or an investment fund, it cannot offer guarantees.

The previous dissertation (Huerva, 2018) referred to the fact that immigrant workers from the Middle East sent money remittances to their countries of origin. Now, reference can be made to African countries with significant variations in currency depreciation and inflation, which

[63] MLN is the ticker of Melon, currently Enzyme Finance.
[64] Coins that exist on exchanges but are dead (nobody uses them).

use cryptocurrencies to buy and exchange, no longer care that the currency has one parity or another; exchanges are made in crypto, generally referenced to the dollar.

The DAOs are considered investment funds in crypto assets. However, some support a decentralized AI technological project (SingularityDAO) or EduDao, a DAO of the Bitdao.io ecosystem that brings together eight universities and channels funds for education. In addition, due to the energy casuistry mentioned in the section related to energy determinism, Bitcoin requires too much energy as it scales; it does not make sense that an asset transaction consumes so much energy. Bitcoin, as version 1.0 of the decentralized application, is a big step; it opens a new world of possibilities. However, not everything ends with Bitcoin; it was simply a step, an experiment, and a demonstration.

The crypto market is highly interdependent because it generates greater interdependence than traditional markets. The popularity and accessibility increase the volatility; bubbles are constantly being created and burst. As an experiment of a "pure" free market without regulation, it is correct because it shows that greater interdependence equals greater possibilities of empowerment and wealth generation, but even if there is a greater interdependence of the nodes, if this interdependence is negative feedback, then there is the tendency to concentration and monopoly, coinciding with Elias, Piketty or others that have been seen throughout this dissertation. In addition, systems require regulation; without regulation, there is no system. This is why decentralized regulation is required: no over-concentration should cause inequality (negative feedback). It sounds nice that people in Venezuela can earn money or that new artists can project themselves thanks to NFTs, but actually this is not the case[65]; it becomes an extension of capitalism that is not sustained. The important thing in all of this is to find a way to reverse the feedback from negative to positive.

17.2 Model Application Strategy

This process starts by analyzing social transitions that have been seen previously. It is crucial to minimize the "Engels pause" (Frey, 2019) and the "shock of the future" (Toffler, 1970) changes. While this premise initially shapes the strategy, it is not the only factor to consider when determining the best way to apply the model to society. During this phase, it is important to reflect on John Christian Laursen's work on skepticism or social dogmatism in politics (Laursen, 2009). Both skepticism and dogmatism have led to great atrocities committed by humans. The scientific orientation described at the beginning of this research is particularly relevant to this

[65] It is important to note that the dynamics of video games operate like pyramid schemes. Axe Infinity serves as an example. A team of playable characters can cost $2,000-$3,500 (2021-2022). Those who purchase these characters can play with them, but in practice, they rent them out to others to play for them, earning 50% of all profits generated by their characters. This model also applies to many games with powerful objects, weapons, or characters. One can buy an NFT that represents a highly powerful character, and whoever purchases it can rent it out to gain an advantage over those who do not have it, promoting a game model called "pay per win." This model perpetuates inequality; those with more money are more likely to win the game. Moreover, in some cases, NFT art operates in a legal grey area regarding ownership rights. Many artistic NFTs are not even created by people; algorithms generate them.

moment, as the project is a scientific one, and experimentation is needed. As Marcuse states: "Technics by itself can promote authoritarianism as well as liberty, scarcity as well as abundance, the extension as well as the abolition of toil. National Socialism is a striking example of the ways in which a highly rationalized and mechanized economy with the utmost efficiency in production can operate in the interest of totalitarian oppression and continued scarcity. The Third Reich is indeed a form of "technocracy": the technical considerations of imperialistic efficiency and rationality supersede the traditional standards of profitability and general welfare" (Marcuse, 1941). As seen before, powers take advantage of technology,

The latest Atlas of European Values is observed, which shows that the institution with the least credibility is the political parties (Halman et al., 2022). As well as the interview with Pippa Norris, who describes the context in which democracy is found, also mentions that people do not feel represented (Ibid.). Is there skepticism in "the system"? Is the ability to provide security from institutions reduced? How do we change the power structures that are the sources of the problem?

The researcher first considers Ulrich Beck and his concept of risk society (Beck, 1998) as well as the work of Victor Climent (Climent, 2007). The Global Risk Report of the World Economic Forum is also examined, revealing a change in risk perception over the years (WEF, 2020). A comparison between reports from the beginning of the millennium and current ones (WEF, 2023) shows that environmental aspects, when they are mentioned, no longer disappear from the reports and now occupy the top spots, having replaced economic risks[66].

As mentioned in this research, ecological and environmental problems are social problems. It has also been observed that systems interact. A system's transformation and feedback process interact with other systems' transformation and feedback processes. It has also been observed that natural laws govern environmental ecosystems, and social laws govern human ecosystems and have a relationship between them. The technological tool of social organization is the institution; it is the tool by which the process of transformation and feedback is articulated.

The current tool is unsuitable for the transformation and feedback processes of environmental ecosystems (Fig 12). If it were suitable, this problem would not exist. The institutional form itself must change, but changing what gives life and meaning to the institution is not easy. However, this change has happened throughout history. In this regard, the researcher recalls Professor Ricardo Soto of the University of Barcelona in a history class, he responded to the question of why, in feudal times, the serfs did not revolt against such an unfair system. This question highlights the difficulty of changing the very nature of a system. His answer was: "…it

[66] Although in the last report (WEF, 2023), the first risk is the "cost-of-living crisis," classified as social, it could also be classified in blue as "economic."

was difficult to revolt against the feudal religious conception, and when they revolted later, they did not get anywhere because they had nothing to fall back on, there was no new ideology, there was no capital, there was no knowledge that we have now, they only knew a few tools for one type of system, and that is why they always came back to the same thing. They fought against the warlords and reproduced the same warlord behavior when they came to power".

Throughout history, institutions have undergone significant changes, some of which have caused harm to ecosystems, even the over-exploitation of resources that gave these institutions their power. These actions have often led to their eventual downfall, as was the case with the Khmer civilization. It should be difficult to see that everything was collapsing and not realize that the organization was the main problem, but because there are no organizational alternatives (magical explanation), there is no stop to the downfall. Changes occur in the institutions' crisis processes, and technology plays a crucial role, and maybe something similar could be happening today; technological possibilities go beyond previous technologies, which are the current ones, and that cannot respond to current and future contextual (physical and social) challenges.

International institutions reproduce inequalities (Fehl & Freistein, 2020), and suffer crises (in organizations/to organizations/about organizations) (Kuipers & Wolbers, 2021). Aseema Sinha differentiates between crisis within the institution from the crisis of the institution. The latter describes it as follows: "These occur when the architecture of the institution does not work as intended and when members, especially leading members, begin to question the utility of the structure itself" (Sinha, 2021). Sinha explains the institutional paradox in which the world lives through the example of the World Trade Organization (WTO) and shows how centralized institutions come into conflict with the many interests that exist today. Institutions (structures) created at a time, with a number and a hegemony of interests very different from the current situation. That centralized and hierarchical structure then responded to the lack of diversity through hegemony. When this diversity grows and assumes power (the way to generate economic wealth is by maximizing economic interdependence), the centralized form can no longer assume diversity (see linear model in Fig. 18).

The way of generating wealth through global economic interdependence is confronted with the new locality specifications conditioned by energy and the environment (WEF, 2020; 2023) (this opens the debate between Global vs. Local). As has been observed in theoretical sections of the research, the greater the magnitude of the governance institution, the less capacity for change, even in the face of catastrophic contextual changes, sudden or not. The centralized power structure itself, which generates multiple centralized power structures, makes it difficult for the institution to change as it grows.

The researcher also refers to the Atlas of European Values, which provides a useful classification for the strategy. The classification distinguishes and typifies individuals between a) Biggest fan of democracy, b) Biggest fan of "a strong man," c) Biggest fan of technocracy, and

d) Biggest supporter of military rule (Halman et al., 2022). The researcher identifies relationships between the model developed in this investigation and groups a, b, and c. However, directly transforming the system of political organization requires a great amount of energy and generates power conflicts that can be avoided in other ways. So, considering these aspects, and based on 7, 8, 9, and 11 theoretical blocks, these show that the strategy should go the other way around. In such a way that the definition of the execution first puts the focus on the individual so that the individuals can test if the model helps them to organize themselves better. Once one has tested oneself, and assessed if it works (individual organization), then it will make sense and can be considered in a more elevated collective and common context (social organization).

First, the data empowers the individual; one has the possibility to make better decisions based on his data[67]. If the individual observes this, one will understand that it can also be used for social decision-making. This action takes place far from the sphere of power represented by the party system. It is supported by science through a scientific DAO (DAO_{sc}) that supports the development of the tool for scientific and social purposes. A scientific DAO that can move autonomously would make it easier to find help from entities for financing and initial execution. Defining the approach of the action as a scientific and not a political DAO is important because:

1. The model is a scientific investigation.
2. Through a scientific DAO, experiments can be carried out. Scientific tests are carried out.
3. As seen throughout the work, the answers to the challenges humanity must face should increasingly come from the scientific side and not from the political interests side.
4. Scientific convergence is a path; it is increasingly present in all areas of society and surpasses politics. Politics is governed by the component of power, which resists scientific convergence against its interests. Centralized power is a limiter of progress.
5. The party system and the current political form cannot provide answers to increasingly complex contexts in society; science can.
6. The formal institutional model does not currently allow the registration of a DAO as a political party. But it may be easier to create a scientific DAO institution, because it has much more way and scope than not a political party.
7. A DAO_{SC} does not have a political ideology.
8. Science is for society; it has an important legitimizing element.
9. The social application or scalability of the model comes from the individual; if the individual discovers that one can make better individual decisions based on his data, then it will be easier for him to scale the model to collective decisions. One leads to the other; conflicts are avoided.

[67] Having better and more accurate information does not mean the individual take a better decision, but the probabilities to take a better decision are increased.

10. Participating in the DAO is participating in a scientific project, regardless of whether one is a scientist or not; it brings science closer to society and makes them participate.

17.3 Product Definition

There is a new world to discover for humanity through new forms of organization; the dissertation shows that depending on how society is organized, new possibilities and paths for progress, both individual and collective, are enabled. The following process is to compress this analysis, and the conceptualized tool, into a single element that can be understood and used, like a product.

The designed product has some characteristics that a) allow to take control of the data, b) applies the RGDP rights in a practical way, c) unites a social position before the situation of lack of control of the current data, d) enables the possibility of making better decisions based on data in a reliable and secure way; at the same time it enables e) carry out paid tasks, in f) a controlled environment for all owners.

It has been suggested that the UILL can be considered a legal AI, but the product is the creation of a personal AI. Owning an AI implies individual empowerment, which has liberal connotations and allows for privacy control. The interconnectedness of AI implies social empowerment, which has social connotations and allows for transparent control and better consensus[68].

The research speculates that, following the argument of the analysis corresponding to magic, technologies that explain a reality that is not seen have magical connotations and is given additional legitimacy. People continue to use Google Maps even when it fails because it helps them visualize and understand reality in a way they cannot see, people want that Google Maps work (explain reality in a magical way, explain what is not seen). This product conceptualization of this research fits into this vision, as people wouldn't mind having their own artificial intelligence if they know it is theirs, not controlled by others, looks after their interests and everyone's, and helps them in their daily lives.

The product requires:

- A hardware that the individual already owns and that captures the data, such as a mobile phone, a smartwatch with pulse sensors, a video game console, a washing machine, etc.
- A software that includes the data capture module (UILL), the asset management module (DAO), the data matrix (social machine), and the hybrid model architecture.
- A decentralized application marketplace, dApps.

[68] Labels and smart contracts enable control over privacy and transparency. With maximum privacy for everyone, the matrix allows for anonymous and private comparison of data through dApps.

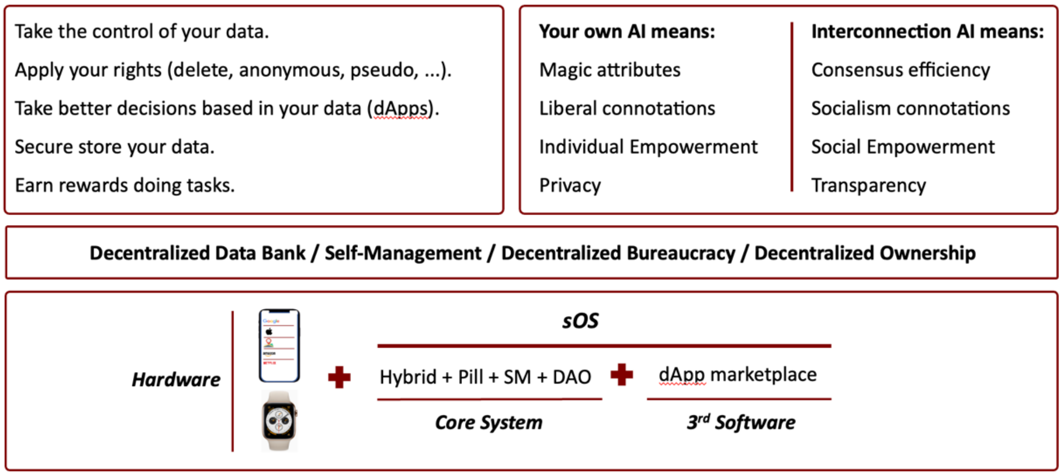

Figure 38. Represents the main outline of the product, features, components, and implications are shown.

17.4 Marketplace, the ecosystem of functionalities (dApps)

"A decentralized app is an app that is built on a decentralized network. This type of app is not controlled by a single entity, but is instead distributed among a group of users. Decentralized apps have many advantages, including increased security and privacy, and the ability to run even if a single server is down" (Open AI, 2022). The typical example of a dApp is Bitcoin, and so is Ethereum.

The model that is conceptualized and designed in this thesis would fit into a type I dApp, which is the one that establishes the protocol; the protocol is the hybrid system. Type II dApps are those that use the type I protocol to function (Johnston et al., 2014). There are various types of dApps with multiple functionalities (Cai et al., 2018), and currently, diverse dApp ecosystems are being created, all based on PoW or PoS validation and consensus. The ecosystem that emerges from the research is based on validation and consensus through data and people's decisions, Proof of You (PoY). In the proposed model, access and use to the data that an individual can obtain is done through type II dApps that make up the Marketplace. These dApps allow individuals to use their data according to the functionalities for which they have been designed, and they are the ones that allow communication with the social machine.

These dApps are developed by means of tasks DAO owners do through proposals, delegations, validations, executions, and financing carried out by everyone, without black boxes. Unlike current applications, where the application owner has access to user data, in the dApp ecosystem suggested by the study, no one can access the data managed by the dApp, only the UILL owner, the individual who uses it.

18 Comparative Analysis

The researcher had the opportunity to contact the Barcelona City Council and access the Strategic Framework on the definition of AI in the city of Barcelona, or "Government Measure of Municipal Strategy of Algorithms and Data for the Ethical Impulse of AI" (the Measure), which is under the Commissioner for Digital Innovation, Electronic Administration and Good Governance. The researcher seized this opportunity to conduct a comparative analysis between the model proposed by the City Council and the model defended in this thesis. This is the application of the theoretical and methodological frameworks of this research.

18.1 Measure Context

The Measure begins with a brief introduction about global changes, the current situation, and the context. Reference is made to the fourth industrial revolution and the "exponentiality" in which current society is immersed. The possibilities of artificial intelligence are defined as the use of big data + algorithms + learning methods (ML). The possibilities of this combination imply the need to design an action plan. In 2020, the City Council issued an Institutional Declaration in support of an Ethical and Reliable Municipal Technological Model. This is based on the following principles:

- Technological humanism for scientific advancement.
- New digital rights for citizens.
- Control over the use of artificial intelligence technologies in the public sector.

The Coalition of Cities for Digital Rights has been created, with more than 50 cities led by New York, Barcelona, and Amsterdam. For this reason, the Barcelona City Council wishes to be a reference in this field.

18.2 Measure Objectives

The city of Barcelona aims to export its artificial intelligence model to the rest of the world, becoming a driving force for progress and a key component for technological adaptation in the 21st century. Its objective is to create an open, inclusive, and resilient city. For this purpose, objectives are defined in two directions:

- Boost the use of artificial intelligence for citizens' rights, shifting from reactive to proactive administration.
- Establish governance and management mechanisms, including goals such as maintaining and increasing democratic control over artificial intelligence by public institutions and citizens, ensuring transparency and audibility, and defining the liability regime.

The application areas for the use of artificial intelligence are distinguished into a) development of public policies, b) internal municipal management, c) provision of public services, d) design and construction of AI-based systems, and finally, e) public hiring.

18.3 Analysis and Discussion, Comparison with the Thesis Model

The model defended in this thesis shares the Measure the technological humanism and guiding principles. Regarding the objectives, the difference lies not so much in what but in how they are achieved.

The measure refers to a centralized artificial intelligence (AI), also known as a central entity or "singleton," that presents all the risks mentioned in the section on bureaucratic logic in a centralized AI. For this reason, the document gives more weight to defining ways of institutional efficiency and AI control to define the trajectory of the City Council rather than focusing on social empowerment or designing better policies through AI. The document focuses on improving the institution and society through it, not on civil society directly. The focus is on the institution as a governing entity and, from there on, individuals, suggesting that there will be a good civil society if there is a good City Council. City Council as the source of policy.

The proposed measure consists of using AI technology to improve the effectiveness and efficiency of the current institutional model, which is centralized. Currently, policy action and definition are centered on a hierarchically superior node (the City Council) and are directed toward the rest of the nodes (the Civil Society) in a mostly unidirectional manner. Although this concept is similar to that of the Social Credit model (State + AI + big data), the regulations are different due to the control, more or less representative (e.g., democratic), and bureaucratic of the model. As seen, the greater the number of people who manage a resource (more population have more control over governance), the greater their ability to distribute it, the less their tendency towards oligarchy, and the greater their capacity for progress.

As observed in the complexity section, the centralized model is not emergent and is limited by the highest spheres of complexity (CSp_n). It does not handle well in complex situations, and although it may be optimal in low-complexity environments, it loses resilience and effectiveness when complexity is added. This is why there are two paradoxes in the document. On the one hand, it is identified as an objective to improve or allow social resilience, but the proposed solution is to devise a centralized tool to achieve it. On the other hand, the strategic plan aims to achieve greater diversity, but centralized models are not known for handling diversity well, as it generates complexity, and centralized models handle uniformity well. Both contradictions arise because the form does not fit the objective. It is also logical that entities operating in centralized paradigms seek centralized solutions, not decentralized ones, as this goes beyond their perspective of the context.

It is true that AI techniques applied to a state or municipality can indeed help design better policies and be more efficient and effective bureaucratically than currently, in addition to achieving greater diversity and improving resilience. However, according to the theory presented in this dissertation, the best way to achieve a society as defined and aspired to is not through a centralized model but a decentralized one. Society is not linear, and applying a linear solution to a nonlinear problem is not time-resolving: the current situation can be improved, but it will remain unresolved.

The model developed in this dissertation focuses on individuals, where AI is decentralized, and each individual has their own AI. This model is P2P, representing an assembly of AI, and has more efficient, legitimate, and effective control mechanisms than the centralized model. As defined in the technology section, institutions are social, technological tools for managing and controlling the complexity of the context, and current technical knowledge allows for designing much better tools for this purpose.

As observed, a municipality is a more complex social technology than its previous version of parishes. The perspective of this research is that the institution does not adopt the technology: it is not the municipality that uses AI technology for its own purposes -inferring that its own purposes are the same as those of the citizens-, but rather civil society adopts the technology directly. Everyone is the municipality[69], civil society become more technology. The model is expressed as a matrix, owned by all who compose it, that relates individuals to achieve common objectives.

Currently, Municipalities and States are the central elements (matrices), legitimized by a social contract and representativeness. They are the nodes to which everyone is connected and act as intermediaries between individuals to achieve common goals. The paradigm of centralization shows an inherent perversity that requires control of power nodes. The model that emerges from the research is not affected by this situation for three reasons:

1. Research is based on a hybrid system: human and machine domains for tool control. The human domain refers to nodes, and the machine domain relates to links between nodes. The dynamics are concatenated, that is, between a node (human) and a link (machine), and validation and responsibility always fall on the node. The model, by means of controlling interdependencies between individuals, defines the stigmergy necessary to create an emergent system.
2. The designed model's conception differs from an AI that governs, learns on its own, is hierarchically superior to the rest of the nodes, is normative, and defines social action (Singleton). A conception is maintained in which civil society is passive, allows the machine to act, even if it controls it, and lets it govern. The paradigm that defends the research understands DAO and the hybrid form as a mediator between people to organize better and achieve common goals; better control of interdependencies can cause social action to flourish. That is why civil society is proactive and jointly carries out government action, since AI links nodes to carry out this action more effectively, efficiently,

[69] The only slogan associated with The DAO was: DAO is code!

representatively, and equitably, with a good balance between diversity and consensus and with the maximization of liberties.

3. It is not about an AI that governs above all but that everyone self-governs through their AI. Normativity is given by oneself and by the community through the set of AI directly. The legitimacy element obtained this way is much higher than if a third party defines it.

The decentralized model that emerges from this research represents not only a technological upgrade of the institution, in which civil society becomes the City Council but also a new paradigm based on emergence. In this model, the source of policy is the node itself, not a central entity like the City Council, that is, the individual itself. All nodes generate policies and form a decentralized regulation based on the consensuses reached by smart contracts, according to the labels of individuals, through a hybrid bureaucratic system. This approach minimizes the risk of centralized bad practices and perversions of power.

18.4 Risks of the measure

If we analyze and compare the risks of intelligent systems defined by the measure, we observe that they are mainly inherent to a centralized conception rather than a decentralized one.

1. Risk of malicious use. The first risk refers to the tool's misuse, in which the node uses it for its own interest at the expense of others. Essentially, it is the same dilemma of "who controls the controller," and this problem increases as the structure grows. The solution proposed by the Measure follows the logic of centralization, which implies the creation of various control agencies and algorithm audits, increasing the bureaucracy to control the new context. The line of research has moved towards another paradigm: the paradigm that the best way to prevent malicious use by a node of the power tool is to decentralize that power tool.
2. Risk of amplification of subjectivity, biases, and error. AI bias can be observed in (Najibi, 2020). If AI learns from someone subjective, then the AI will be subjective, and the individual's bias will be the AI's bias. However, the researcher considers that in an emergent schema, non-centralized AI, and, with the ability to capture data offered by the three-dimensional model (physical, virtual, cognitive) by comparing data of all individuals (AI categorizes data, labels, bias), should be able to detect the subjective biases of each individual and even predict them. The comparison between individual's data of all AIs can categorize different kind of biases. If there is an AI network, each individual's AI could detect (categorize) the bias in that case. Bias is important as it explains a lot about the individual. Despite individuals being subjective agents, achieving objectivity requires more information and processing. Therefore, the machine domain should allow for the establishment of correct relationships by calculating and predicting interdependencies, considering individuals' subjectivity (control of the feedback loop). It

is important to note that improving objectivity requires greater informational diversity and processing by each individual. Objectivity and rationality become more essential for making appropriate decisions that affect the rest of individuals (non-linearity); or from individual complex sphere (CSp_1) to the social sphere (CSp_n). In addition, the sum of subjectivities explains social reality, so the model should detect them and establish relationship processes (interdependencies) to promote progress (see the definition of progress) based on data.

3. Risk of data processing, design, and ML. It refers to the fact that errors are not from the original human design but from future designs that the machine will make through ML. The control over a centralized AI, which learns by itself and makes counterproductive decisions or unwanted outcomes, will depend on the extent to which its process is controlled. This implies the creation of control agencies. In the model that arises from the research, the concatenation process on which the hybrid form (human domain/machine domain) is based allows greater control over the undesired effects of ML. Furthermore, regarding this last aspect, the measure poses the risk of how to obtain citizens' data without violating their rights. Giving absolute data control to a single entity generates many perversions and poses a very high risk due to its great capacity for influence. This problem will always be inherent in a centralized model. The decentralized model defended by this thesis obtains data legitimately while also protecting privacy (UILL). Individuals do not have to give anyone their data; they simply retain it, and their AI (UILL) manages it. This AI is subject to the individual's interests through the progress it produces. Basically, this element represents individual and social empowerment (emancipation). The DAO allows all nodes to own the data, which are private assets of the individual. With them, organizing better and finding individual and collective consensus is possible. It is not necessary to hand over one’s data to a third party to design a policy. Each individual's artificial intelligence communicates with the other AIs while maintaining privacy. Only if there is unanimous agreement among all members can different layers of anonymity be opened to some IDs with specific labels. The hybrid model allows for proposing and executing such agreements.
4. Risk of opacity and black boxes. These are much more difficult elements to happen and create in a decentralized power structure than in a centralized one. The inherent transparency element in a decentralized model increases the chances of detecting a black box, a bad practice, or opacity compared to a centralized environment.

18.5 Guiding Principles

Given that a centralized model entails risks, a regulatory framework has been established to prevent these risks. Consequently, the Governance Measure defines the Guiding Principles that govern the implementation of AI. This research and model design follows the scientific guide described at the beginning of this dissertation. In the Measure, the principles are:

1. The first group of Guiding Principles refers to human supervision due to black boxes, the possible malicious intent of the designer, and the unintended consequences of designs. Although autonomous, the machine must be able to be controlled by the individual. The model developed in the thesis is a hybrid form that guarantees that control is always with the node or individual since the model starts from the individual, and the machine domain establishes the relationships between individuals based on data and according to a progress function. The researcher considers that the set of Guiding Principles (GP1) is inherent in the devised model.
2. The second group corresponds to technical robustness and model security. Decentralized models are much more robust and secure than centralized models since it is easier to hack a single node than all nodes on the network. The decentralized model is based on fragmentation and redundancy, which requires much more energy and, so far, more expensive computing solutions, although they are becoming increasingly accessible. No single AI or Singleton exists, but each node has its own AI, which all comprise the network model. The Guiding Principles (GP2) are also intrinsic to the model that defends the thesis.
3. The third group of Guiding Principles refers to privacy and data governance (GP3). It is difficult to find a balance between privacy, security, and freedoms, so the first part of the implementation was dedicated to creating "the Uill," which allows individual and social empowerment of data and establishes new boundaries between privacy, security, and freedoms. It is a distributed personal AI that applies the RGDP law and generates a decentralized personal record of all data. This allows for improved habits and policy creation. The model presents a paradigm where no central entity collects or governs the data of all nodes, but all nodes own their data and share it through their AI in an anonymous and controlled manner to find consensus and act emergently. The model presented in the thesis has considered the Guiding Principle (GP3).
4. Regarding the Guiding Principles related to transparency, the proposed model in the thesis is designed to be transparent and traceable in all processes. This model is based on DLP technology, which has both elements as distinctive features. In addition to maintaining privacy, the model complies with Guiding Principle 4 and is intended to be transparent and traceable.
5. GP5 is established regarding diversity, inclusion, and equity. AI is the mathematical design of systems that display intelligent behavior by analyzing a context and taking autonomous actions according to a function. It is an automated process of mathematical calculations that responds to various functions and generates an output. In the research model being developed, this output is defined as the definition of research progress, which includes equality, the relationship between diversity and consensus, and the

maximization of freedoms. This is achieved through control of interdependence and the type of feedback. The function of AI, according to the objectives of each node, will create different links to achieve the best relationship in that output. Synergy is not only about homogeneity, but it requires heterogeneity. As seen before, the agents involved in a synergistic relationship must be different to exchange elements they do not possess. If both agents are the same and have the same things, they may have cohesion but not a greater capacity for synergy, and therefore they will exchange little. Diversity is where human richness lies. That is why the Guiding Principles (GP5) that refer to diversity, inclusion, and equity are fundamental in the model conceptualized in the thesis.

6. The sixth group of Guiding Principles (GP6) refers, on the one hand, to equality and social commitment; and, on the other hand, to environmental commitment. This measure relates solely to the UN's objectives for 2030. Regarding the Guiding Principle of equality, it is an aspect that, as seen in the previous point, is found in the output of the conceptualized model. Regarding the environmental Guiding Principle, the artificial intelligence solution advocated by the thesis does not have a properly established environmental principle because the tool complies with established ecological requirements. Instead, it focuses on this problem from another perspective: the environmental problem (physical context/open physical system) is a problem defined by social organization (social context/open social system) with resources. As seen in the technology and context sections and the political definition, the path followed by this research proposes ways to organize a better society concerning resources to address externalities. One of the research's motivations is to define reconciling solutions in situations where the states-market binomial cannot respond to this type of externalities, such as ecosystem destruction, inequality, or common resource management. The practical application of the decentralized artificial intelligence model presented in this research allows for consensus that aligns with individual objectives, common objectives, and environmental requirements. Each individual has an ecological representation or function "β" composed of variables ranging from what they buy and consume to the fuel they require, the waste they generate, or the electricity they consume, among other things. This not only allows for more direct measurement of their environmental impact but also the sum of these β functions for n individuals refers to the whole of society. It also allows for designing policies at both individual and collective levels to achieve common environmental objectives. An individual or a group may have high ecological goals and values, but if their environment β does not fit them, a correction in their data should be applied. The model is flexible, allowing prices to be different for different people and multiple transfers between multiple people according to their attributes, labels, and externalities (those they suffer and those they generate). The model allows, for example, for a different energy price to be set for each person depending on the set of labels that

make up the individual. The price varies depending on whether it is used for work or leisure, inequality indicators, whether the person shares their car to reduce CO_2 emissions, the cost of infrastructure, their mood, the social capital they generate, their recycling ability, their CO_2 emissions, or the number of children, among many other variables. Each individual has different relationships between these elements, and the variables are computed differently depending on the individual, the agreement between individuals, and the output of progress. Just as the transfers that will be made when refueling will not only be made to the fuel owner[70] but also to third parties or from third parties according to the labels or to cover costs for individuals with a typology of labels, to infrastructure maintenance or investment in new energy technology.

7. The seventh Guiding Principles (PR7) group relates to responsibility, accountability, and democratic control. These aspects are fundamental when designing a research model. Therefore, a decentralized model was devised through DLT. The traceability provided by this technology allows for accountability and even retroactivity. In centralized models, the responsibility lies with the hierarchically superior central node with decision-making legitimacy. In contrast, in decentralized models, the responsibility lies with the entire network of nodes that make the decision.

18.5 Reflection

The research model aims to increase legitimacy through more adequate representation, greater transparency, and data reliability as the basis for better policy. The model is based on equal dialogue among individuals through AI. The measure establishes that the development of AI must comply with the standards of the Creative Commons license. The research model developed was registered in 2021 under this same license under the name Social Operative System (sOS). And follows the principles of Ethical OS[71].

The model developed in the research allows for behavior characteristics of an emergent system. It does not follow exactly a bottom-up behavior, thus is more from bottom-to-bottom, and self-organizing process. AI alone has potential, but when combined in a distributed manner, it can achieve even greater potential.

The research aims to achieve economic and social empowerment through an organization based on control, prediction of transformation, and feedback processes. This organization understands non-linearity through scientific explanation, defining an open, distributed, dynamic, inclusive, and risk-managed approach. Furthermore, it is legitimized by the whole, not a central hierarchical node, but rather by all individuals directly involved. This allows for much broader

[70] That the person refueling pays less does not mean that the fuel owner earns less; transfers come not from a single individual but from many.
[71] https://ethicalos.org

diversity management and consensus-building to organize society's progress and tackle the challenges it must face.

19 Conclusions

Societies are organized to encompass complexity, and there is a trajectory and a way to manage complexity and different forms of individual and collective organization according to contexts and resources. The ways of encompassing complexity are produced through recursive technological processes, both physical and social. The relationship between society and technology is a recursive relationship: society is part of technology, and technology is part of society. The forms of social organization are a social technology that changes over time according to the complexity of the contexts and the inherent recursiveness; this does not exempt power dynamics takes advantage of technologies shaping the changes in society. And, if physical technologies allow greater possibilities of projection, the possibilities that social technology develops based on them are more remarkable. In the same way, the greater the social technology, the more developed it is, and the greater the possibilities of developing physical technology. In this recursive relationship, emancipatory technologies are those that allow greater positive externalities, greater efficiency than previous technologies, adopted to society by law of increasing adoption returns and by means of the network effect. Given these elements, the customary powers that control the previous technologies have a limited capacity; their best solution is to be part of the new technology.

The level of complexity of the contexts defines the optimal organization form; systems can function centrally with little energy in a simple context, and they are optimal, but in complex contexts, the centralized structure becomes ineffective and loses efficiency. Systems that follow a decentralized scheme are inefficient in simple contexts but effective in complex ones. The degree between centralization and decentralization of the structure will define the system's energy level, with decentralized systems requiring the most energy and centralized systems the most efficient.

Societal organization can be represented through cybernetic systems, where contextual elements (systems) are inputs and outputs, and computational elements enable transformation and feedback processes. Power dynamics play a key role in human systems, explaining part of the transformation and feedback processes in human systems and other systems. Given that power dynamics typically involve centralized organization, it can impact the suitability of the optimal organizational form in response to a given context (multiple systems).

When the physical and social contexts do not correspond, the transformation and feedback process cannot respond to the context (based on another transformation and feedback process), a dissonance of the system is produced, and the power structure organization over what explains reality does not allow to change so tends to entropy chaos. The form of organization does not respond to the new context; it does not explain reality. The dissonance is not sustainable over time and tends to change to seek another explanation and organize according to that explanation.

Centralized forms of organization do not allow proper management of resources in more complex contexts, regardless of whether they are public or private. Centralized structures follow a linear logic, and the social aggregate is not linear; complex societies cannot be organized linearly. Non-complexity tends to linearity, and complexity tends to non-linearity.

Emergent systems manage complexity by developing decentralized structures; each element comprising the system has a self-governance capacity. These are systems with a single rationality, with greater predictability, since the elements that compose it are the same. Complex emergent systems use stigmergy to achieve this unique behavior (same rationality). Human systems are diverse, we generate various criteria, we do not have a single rationality, and we do not generate emergent behavior per se; emergent systems to be successful in high complexity contexts require much energy.

Individuals can generate emergent organizational behaviors when the forms of the centralized organization fall or do not exist. The amount of energy they require, the amount of information they need, and the predictability of the necessary action make them too many variables and information to compute for an individual. That is why emergent behaviors are often considered spontaneous. If a computational capacity allows this information relationship, then self-organization can exist. Societies can encompass greater complexity and progress depending on the ability to control the transformation processes and positive or negative feedback (definition of politics or governance) on an individual's life. Depending on how interdependencies are configured, society can embrace more complex spheres. In societies where governance is open to all, more individuals govern, all can control the governance, and the management resources can reach higher levels of progress and complexity rather than in societies where only a few can control governance and resource relationships regardless of the ideology behind the management resources.

Any system requires regulation; non-regulation tends to entropy, and regulating all the individuals that make up a society is fundamental for its dynamics and coordination; better regulation is better progress. Centralized regulation entails centralized redistribution and follows a logic of concentration of resources; it tends to generate oligarchies, limiting progress. Decentralized regulation is not the absence of regulation, entails decentralized distribution and coordinated action, and does not follow the logic of the concentration of resources so that a system will offer greater progress according to the capacity to control the governance on the part of the individuals. The greater capacity of governance of individuals equals higher levels of progress. The ability to encompass the complexity of society is proportional to the configuration of interdependencies. Societies can encompass greater complexity by controlling interdependencies.

The conjunction of physical and social technologies makes it possible to improve environmental sustainability, improve control in the face of sudden contextual changes, and simultaneously allow a trajectory of progress. Progress is the ability to encompass greater spheres of complexity by controlling the transformation processes and feedback according to the context (multiple sets of systems). And the human capacity to encompass progress and complexity is defined by the elements of freedom, equality, and the relationship between heterogeneity and consensus. Both physical and social technologies follow a dynamic, they replace and are built over the previous ones; current technology allows greater possibilities than the current forms of organization. There is more than liberalism, socialism, markets, or States. These make sense from centralized power, vertical perspective, and centralized power is a limiter of progress as complexity increases. Technological empowerment and democratization create complexity, generate interdependencies, and tend to decentralize powers by creating new powers (accessibility and creation of new tools). Empowerment and democratization are linked to projection (freedom) and isonomy (equality); they are part of progress output and configure decentralization.

Context complexity is described in logarithmic and non-linear terms, making it difficult for linear and centralized control tools (institutions) to respond to new, non-linear contexts (generates dissonance). In contrast, an emerging and decentralized tool is more resilient to changes in a complex context. Centralized structures are efficient and effective in less complex contexts, while decentralized structures are effective but inefficient. However, centralized structures become ineffective and inefficient in more complex contexts, while decentralized structures become effective and efficient. So, the solution proposed by the research involves creating an emerging structure based on diversity and human characteristics through data from individuals and ML techniques. The scheme represents an assembly of individuals who communicate through their AI (decentralized AI network).

Converting a human system, based on individual attributes and diversity, to an emergent system to respond to complexity poses an important challenge in the thesis. Hence for a human system to act in the face of complexity as an emergent system require equal and complete information, a neutral power relationship, and the same behavior or predictability of action. Emergent systems can achieve complexity through stigmergy, humans do not have this regulatory system, but humans generate lots of data, which can be used to create "human stigmergy". This means to define a perspective to capture individual and social reality in a wider way, based on Framing Theory (to capture multiple realities) and Homo Ludens Theory (to capture the dynamics of these realities).

In a cybernetic scheme, the relationship within a system between input and output data is the transformation, while the relationship between output and input is the feedback. If a system's input and output data can be captured, a neural learning scheme can define the transformation and feedback process, opening the door to social predictability. Information about social behavior is obtained by comparing the habits of individuals. Current technology can capture physical, virtual, and cognitive or "feeling" data. This research defines a three-dimensional model (physical, virtual, cognitive) to capture all individual information and cross-reference data between individuals, creating a relational schema of data that displays each person's identity and unique data sets. This data should reveal a person's identity through not only the relationship of the edges of the polygon formed by their eyes, nose, and mouth but also frames and game (homo ludens) dynamics through habit data, showing socioeconomic behaviors, friends, joys, fears, insecurities, and trajectories. By comparing data between individuals and analyzing their differences and commonalities, habits and trajectories can be predicted. Social information extracted from data interactions among individuals (from their devices) should enable this prediction. The researcher speculates that habit predictability should be improved by adding more data and diversity from individuals.

This should allow data to make better decisions, find consensus between individuals, and define new policies. Society is more than the sum of its individuals; the result will differ depending on how these individuals are related. Control of interdependencies is the control of synergies; the ability to add or subtract is determined by the feedback of the variables that make up the relationship. The proposed model considers the computation of economic assets (an important variable) and social assets, social capital. These variables currently not measured could likely have a greater weight than economic variables.

The research defines the architecture of the model as follows:

1. The control and ownership of the system are performed through a Decentralized Autonomous Organization (DAO) that represents the social set. This software institution (sOS) allows individuals to simultaneously operate as clients, workers, or investors, while always remaining the system owner.
2. The hybrid model comprises the human and machine domains; the links between both domains are the smart contracts, which define the system dynamics or processes. The human domain makes decisions and performs tasks. In contrast, the machine domain (the set of all individuals' AI) establishes relationships between individuals according to data (labeling), finds synergies, optimizes interdependencies and feedback in the processes of interrelation between individuals, and minimizes information distortions better.
3. The data control module captures, shares, and protects individual data and defines longitudinal individual identity. It captures the individual and social frames and dynamics, called Unique Identity Library Ledger (UILL).
4. The data processing matrix (Social Machine) is the module where individual data is compared and UILLs are processed. Based on this longitudinal data, labels, and interdependencies between diversities (diversity of individuals) can be defined according to smart contracts. Social Machine module calculates all the possible interdependencies based on all individuals' longitudinal data (labels) and: 1) Should optimize the positive or negative feedback according to the data of all individuals (ad-hoc policies). 2) Should find better consensus and trade-offs based on individuals' data.

The combination of the hybrid model, the data capture and preservation module (UILL), the data computing matrix (Social Machine), and the control module (DAO) configure an emergent form of social organization called Social Operative System (sOS). The decentralized models, the emerging systems, do not have a centralized regulation; decentralized regulation cannot be applied from the centralized prism; they require a decentralized regulation. The architecture model defines the bases of a decentralized regulation framework according to all members and personalized to the data of each one.

One critical challenge that the research has faced is the model design based on transition and transferability through the analysis of social transformation. Technological changes encompass Engel’s pause, the shock of the future, and the power dynamics struggle; the current complexity of XXI societies differs from the XIX ones (non-linearity). The research aims to minimize these externalities. So, the decentralized bureaucratic form that defines the investigation (systems dynamics) is made by all individuals and comprises smart contracts. Based on the hybrid model, the human domain performs tasks, and the machine domain seeks the best interdependencies to accomplish tasks. For this, the form comprises a system of labels (label manager) to establish the links and a redundant system to achieve quorum (efficiency). Social interaction is essential for human development; interaction control is developed through the three-dimensional model that captures data from individuals and those received from the debate environment. An environment configured to foster diversity and consensus, collective intelligence, and governed by dialogic principles that reduce bias. The data extracted in these environments can be handy and binding. Because people are constantly voting by means of their data, the debate environment balances the model as a whole, not just phenomenological or based on the action that records the individual's data.

The trajectory followed by Neural Language Processing (NLP) techniques and its latest versions of AI applications, allows for increasingly better treatment of information from a debate environment such as the one suggested by the research. This is achieved by classifying the data, creating new labels, linking them to individuals' labels, ordering the information for the individual, and improving communication between individuals and their AIs.

Because the model is decentralized, it warns of the three deviations of democracy: The plutocracy cannot develop in this decentralized scheme; the information for the organization is the same for all the nodes and includes many more variables that are not only economic. The partitocracy cannot develop in this decentralized model; the relationships are between AIs of the individuals, no intermediaries, and no political parties. The smart contract delegate (machine domain) delimits the centralization degree. It allows the individual to delegate to multiple people whose data (labels) confirms better representativeness and better knowledge to develop the task or make the decision (human domain). All individuals are responsible for governance and for their individual and collective decisions. The dictatorship of the majority or tyranny of the ignorant occurs in the stage of ochlocracy, where information is asymmetric and used by the partitocracy and oligarchy powers. This situation is avoided by defining the machine domain; all the AIs create and share *complete* and equal information for decision-making.

The model does not have consciousness, it does not have human intentionality, it has a function with a progress output. Conceptualizing the model through a decentralized AI and with decentralized data distribution avoids the significant threat that an individual falsifies its data or their AI. At the moment when data and AI computing is decentralized, its hacking difficulty increases as nodes are added to the network. If each individual has an AI and all AI communicates between them, makes it is possible to define a stigmergy process characteristic of emerging systems. A process beyond the reach of human societies, individuals have a limited capacity to process data, but not the individual's AI.

No individual's AI is better or worse than others, and no AI is more educated than others; there is no inequality between AIs, and AIs do not have an intrinsic power motivation. All AIs share the information while human privacy is maintained. AIs use human data to create stigmergy, to create coordinated action by means of labels with a progress output, not to subdue the individual. Where the individual(s) does not arrive, the artificial intelligence comes, just as before; where individual(s) did not arrive with kingdoms, the State comes.

From the beginning of the research until the fall of 2022, there have not been big advances in the use of data and big improvements after the GDPR. There are no forms of control of the data by individuals. Data AI techniques have been used to influence elections rather than define better policies; data is used to influence the population.

This research affirms that technology is crucial in developing innovative forms of economic, political, individual, and collective governance better suited to new contexts. The researcher explicitly acknowledges that the model proposed in this research is not final and that there will always be scope for improvement. The study further highlights that physical and social technologies are intricately linked in a recursive manner, each based on the other and vice versa. As a result, new contexts and technological advancements will continue to shape and enhance governance structures. The research follows a path of complexity adaptation by proposing a solution that requires existing hardware and yet-to-be-developed software.

This research has established the theoretical and regulatory framework and laid the groundwork for the start of experimentation. Many questions can only be answered through experimentation. The following annexes contain tests, case studies, and examples to validate and put the theoretical framework into practice. The researcher has purchased the domains to develop the research: socialbigdata.io; socialOS.dao; socialoperativesystem.com; socialOS.app; sosapp.xyz.

20 Bibliography

The sources cited in this thesis provide a comprehensive overview of the challenges facing modern organizations and institutions in the face of increasing complexity and technological change. By examining these issues in depth, one can develop new models and approaches to address the present challenges and create a better future for all.

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Chapter IV

21. Annex I: Application, from theory to practice

Innovating also requires financing as well; in the innovation section, it can be observed that this revolves around three types of institutions that organize and finance it (Fig. 5). And due to 1) The skepticism of the whole model on the researcher's part. 2) The disruption that research represented at that time. 3) The existence of very few Venture Capitalists who invest in society. It conditioned the researcher to decide not to put much effort into external funding. The researcher early understood that if one obtains greater economic freedom, one will get greater freedom of governance and to operate, similar to what Milton Friedman suggests about the relationship between economic freedom and political freedom (Friedman & Snowden, 2002). As mentioned in the scientific orientation section, if the theoretical model that is defended and that guides the entire dissertation set dictates that technology offers new forms of empowerment (section 7), then the researcher must be consistent with what he supports and prove it.

Considering the accessibility and empowerment that technology provides, along with the mechanization of processes, efficiency, effectiveness, and the ability to generate new ways of creating economy and interdependence, the researcher decided to mechanize a process to generate capital. This would open possibilities for financing the execution of the investigation and the next steps. The researcher created an automated statistical system based on the fluctuation and volatility of the markets, specifically an asset buying and selling algorithm. The experimentation environment was the cryptocurrency market, an example of a complex and unregulated economic system where what some win is what others lose (the centralized Exchange always wins). This forms the basis of the investment part of the DAO_{SC} (Fig. 30, Column y).

21.1 Objectives

- Demonstrate economic, scientific, and social empowerment through new technological tools. (First part).
- According to the form of interdependence generated by a market, the researcher must find ways to turn negative feedback interdependencies into positive feedback interdependencies. Search for a way of scientific and social self-financing. (Second part).
- Lay the foundation for a decentralized autonomous scientific organization (DAO_{SC}) to coordinate the execution and next steps of this research. This DAO is the scientific and social organization to execute and develop the hybrid system, the Uill module, and the social machine. (Third part).

Due to the Scientific Principles that vertebrates this dissertation, where are explicitly no economic interests, no ideological interests, and the benefit of science to the society, this experiment has been conducted with a small amount of money, besides, in the Spanish legislation amounts to over 6.000€ must tribute the 25% of the benefits in selling actions. The goal is scientific, not economic, so all the logics started with 200€-250€.

21.2 Methodology

Any asset that oscillates over time has divergence and convergence statistics that indicate whether the bullish or bearish trend of that asset in the market is strong or weak. The research focused on analyzing various statistics and was found that the Moving Average Convergence Divergence (MACD) statistic is a valid one to automate (Fig. 39). The researcher observed that the convergence indicator consists of a short function (blue line) and a long function (red line). When these two lines cross, a trend change occurs. Typically, bullish momentum occurs when the blue line is above the red line, and bearish momentum occurs when the red line is above the blue line.

Figure 39. The MACD indicator provides trend changes that mostly coincide with price rise or fall trends. Source: Own elaboration on the Binance platform (COTI-USDT).

On the other hand, the strength index statistic, or Relative Strength Index (RSI), was also discovered -for the investigator-. This index sets a minimum and maximum threshold, which act as "triggers" for purchase or sale actions. Initially, automation involved establishing buying or selling moments based on these indicators, as shown in Fig. (40).

Figure 40. The top part of the chart shows the variability of an asset's price, and the bottom part shows the RSI statistic. Two thresholds delimit a pink area on a metric of 0-100, the upper at 70 and the lower at 30. In the chart, one can appreciate the correspondence between buying and selling moments according to the RSI statistic. The data source is the Binance platform (MLN-USDT).

The research created a logic similar to a cybernetic scheme described in the GST section (Fig. 12). The MACD and RSI statistic calculations in Python can be found here[72] and here[73], respectively. It's important to test the logic with actual data and run backtesting to observe the algorithm's behavior, see what it would have done, and analyze the logic (feedback process) when it was bought or sold to make changes. The Python tutorial for creating a backtest can be found here[74].

The research used the Kryll platform to conduct various tests and develop the algorithms; the first versions of schemes were elementary. Losses characterized the first versions and the first months[75]. Little by little, the researcher improved the algorithms, explored and learned to create new indicators, chained them, created conditionals, added complexity to the system, better interpreted the context's complexity, and covered a greater sphere of complexity.

[72] https://www.alpharithms.com/calculate-macd-python-272222/
[73] https://www.alpharithms.com/relative-strength-index-rsi-in-python-470209/
[74] https://www.alpharithms.com/aggregating-time-series-data-with-pandas-resampling-411212/
[75] Just when the markets were bullish.

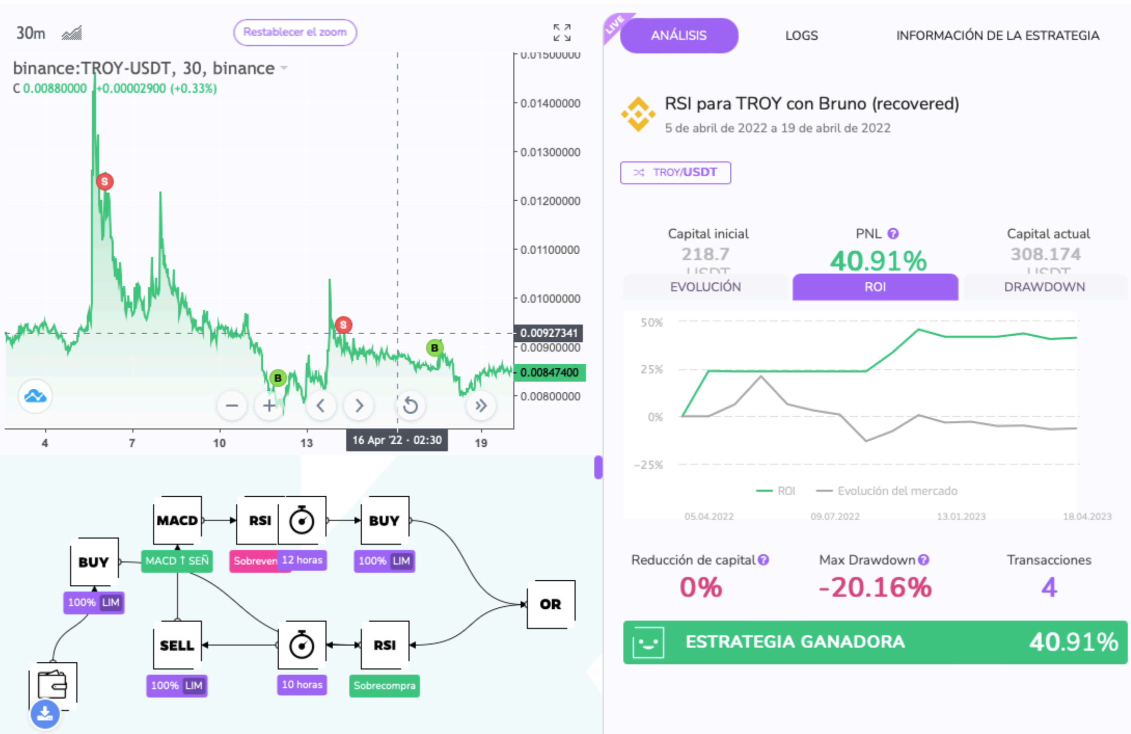

Figure 41. On the bottom-left, it can be appreciated the automatized MACD & RSI logic, which is a cybernetic scheme (Fig. 12), and depending on the input or the context (other systems), the feedback process will respond in one way or another. The behavior, selling actions (red), and buying actions (green) can be seen on the top left. On the right is shown the result of the logic. Source: Own logic in Kryll platform. The logs are at the end (table 1).

It is worth noting that back testing in Kryll is not exempt from errors; while applying the algorithm with historical data can show a certain behavior, situations that were not contemplated during back testing can arise when the algorithm is working. For instance, if an abrupt price variation in a sale or purchase order is limited to a set price, the system might not have time to act, and the operation remains hung on the exchange. Additionally, in the automatic sale process, if the price fall by X% (stop loss), the algorithm did not always execute as it did during back testing. Nevertheless, a solution has always been found, and seeking help has always been answered.

21.2.1. Logic's analysis

At the end of 2021, when the researcher understood that the hybrid model could be plausible, he proposed to 5 people participate in the experiment and invest the same money as the researcher; if they lost, the researcher also lost. The person and the researcher owned each algorithm in such a way that the researcher always maintained 50% ownership of all algorithms. Everyone delegated to the researcher; the responsibility was higher because the researcher's investment was no longer at stake but that of the people participating.

A total of 23 different algorithms were developed, of which 9 worked correctly in the experiment; a logical scheme can work with any asset that oscillates over time, regardless of whether it is cryptographic or not. Each crypto-asset has a different behavior, so the logic for one crypto-asset will probably not work for another crypto-asset. In addition, the behavior of the assets varies over time[76].

The researcher reports that during the trial-and-error phase of the experiment, the crypto market was in a cycle of large increases, and the algorithms lost more than 60%, which coincided with the researcher's learning period. The profits began to be obtained precisely with the succession of falls that characterized the crypto market in the year 2022. The test was terminated, and the algorithms were stopped at the end of September 2022, with none of the participants losing money.

21.3 Feedback change

The researcher collaborates with UB Divulga to promote science in childhood in the Pla Comunitari La Verneda i la Pau, in an unprivileged area of Barcelona. And he has experienced that child technological inequality is a reality in the city. The researcher used the logic seen before and, with the economic benefits, generate an action plan, a pilot to minimize this inequality.

21.3.1. Pilot: Space for Technological Education and Creation

Education is a fundamental element for any organization that must manage greater complexity, making it an increasingly important requirement in complex societies. As discussed earlier, inequalities are reproduced in many ways (Autin & Butera, 2016; Barcelona City Council, 2018; 2019; Fehl & Freistein, 2020), and education is partly responsible for reproducing inequality and social stratification (Celorrio, 2016). This has been the case throughout history, as even in classical times, rhetoric professors were the best paid because they educated the future political class. It has been observed that individuals with more money have better access to education, while those without are relegated to other factors that affect educational, professional, and social advancement, ultimately defining life trajectories (materialist explanation).

As seen in the different sections of this research, although in less complex contexts, inequality makes it possible to be efficient and continue to cover new spheres of complexity, in more complex contexts, inequality is more an obstacle to covering new spheres of complexity. Many more scientists are needed today to cover greater spheres of complexity than ever before, but great scientists are lost along the way because of inequality. Although inequalities are reproduced, the characteristic of cognitive and human diversity affects that it is not a strict reproduction of inequality, and that is why great scientists emerge from unfavorable contexts.

[76] The researcher speculates that adding ML techniques would cover more complexity. Adding interest rate from Central Banks, the returns of investments from key sectors and more contextual information could strength the logic.

And as can be seen throughout the entire investigation, even though there are medians, there is no determinism.

21.3.2. Objectives

Regarding the second objective about the feedback change (21.1 section), it is then established:
1) Minimize technological inequality from childhood, minimize future inequality within the city, and minimize the shock of the future (Toffler, 1970; Brandt, 1995).
2) Promote technological creation and control from childhood. The new generations are part of the change in the world; children cannot be told that they will be able to create a better world and that they have an ally that is technology; if they themselves do not touch technology, it is a black box, and they cannot know how to create it. Children must understand, touch and create technology to control it, and as has been seen in the methodological part, to create is learned by creating Polya (Polya, 1973). If they see themselves as capable of imagining and creating at an early age, they will see themselves as more capable of imagining and creating later.
3) Define a space and a moment of social, technological creation where society directly creates technology for the community. Promote social empowerment.

21.3.3. Method

Robotics is a good introduction to science and technology (STEM); children must be able to create their robots, cars, drones, and sensors. Basic exercises that, by the time they have enough hands to control small parts, will help them to create -or better understand- from a tablet to a smartwatch or to be able to develop more independently through internet tutorials.

It is learned through the social orientation of the technology; when the design of the robot is considered and conceptualized (exercise), its social utility is sought, what is the individual and social benefit of what is done. It must be considered that handling parts that make up robots requires delicacy and precision, attributes that are acquired through learning.

A capsule comprises two sessions of 90 minutes, executed as a project, and two sessions per week, a capsule per week. In the first, the unboxing is done, the project is defined among all the children, the use to which it will be given, and it is built and saved. In the second, the robot is programmed and given its use (game).

To accommodate the age differences within the group (8 to 14 years old) and the varying difficulty levels of the robots, the capsules are designed as one robot for every two children.

Promoting science education should also promote research skills, such as solving problems using existing resources and clues. The learning process involves encouraging children to discover solutions to problems independently while maintaining a cooperative learning approach (Johnson & Johnson, 2009), creating an environment where the best way to compete is to cooperate, as everyone wants to create the same robot.

The capsule's logic follows the Homo Ludens Theory (Huizinga, 1950), and have the "party" element, the game with the robots. Based on this theory, the Pla Comunitari la Verneda i la Pau already configures another game for the child since it is not his school or her house. But the researcher continues looking for a characteristic element of the game that identifies this game with being a scientist; the game is that they are scientists at that moment. Huizinga talks about the "costumes" that identify the game of the individual, suits, and ties for office workers, wigs and robes for judges, t-shirts that identify a sports team, or pajamas and slippers at home are costumes that identify the different games of the game. In this sense, stereotypes have been avoided throughout the dissertation, but the researcher is considering including a white coat as an identity element. Regardless of whether an identifying "costume" is found, the children follow the clean hands' rule upon entering, not only as a symbol that science is aseptic but also because of the casuistry, conservation, and reuse of the pieces.

The capsule ends with the disassembly of the robot, not only because of the reuse of the parts for another project but also to learn that when one creates, one also has to think about how to uncreate; when one does it, one thinks about how it goes to undo. An aspect that is reminiscent of the escalation of commitment (Staw, 1997; Bazerman & Neale, 1992) and bounded rationality.

The robot platform chosen is Microbit; it is easier than Arduino, open hardware, designed for education (> seven years), no soldering required; compatible with any computer, tablet, or smartphone; scalable, and programmable using Scratch. In addition, they configure huge children's programming communities, are free, use a visual interface through blocks, and allow programming from a video game to a robot. There are countless resources on the net, projects already done by other children, tutorials, and ideas. Taken as reference: https://makecode.microbit.org

During the sessions, the guide has already built robots in practice and knows about sensors and parts. Is a young person (16 years old) who is part of the children's team and is someone with whom the children can feel more comfortable and see as an equal. When kids get stuck in the process, the guide shows the solution to one of the groups. Once that group knows how to solve the problem, they then show the rest of the kids how to do it, spreading knowledge and solutions quickly, while this process allows learners to become teachers.

Capsules:

Capsule 1: Unboxing the Microbit and designing a game in Scratch. Kids can see and touch a microprocessor with LEDs and a gyroscope in this capsule. Through Scratch, they learn how the machine generates behavior and how buttons are related to actions. They also see and create simple logical diagrams, create their own game, characters, and story. The dynamics include: 1) Connect the Microbit to the computer. 2) Understand Scratch. 3) Understanding of the Scratch logic by doing them. 4) Create the character and design the background. 5) Control the character with the Microbit gyroscope and buttons. 5) Play the game. 6) Disassemble and store the hardware.

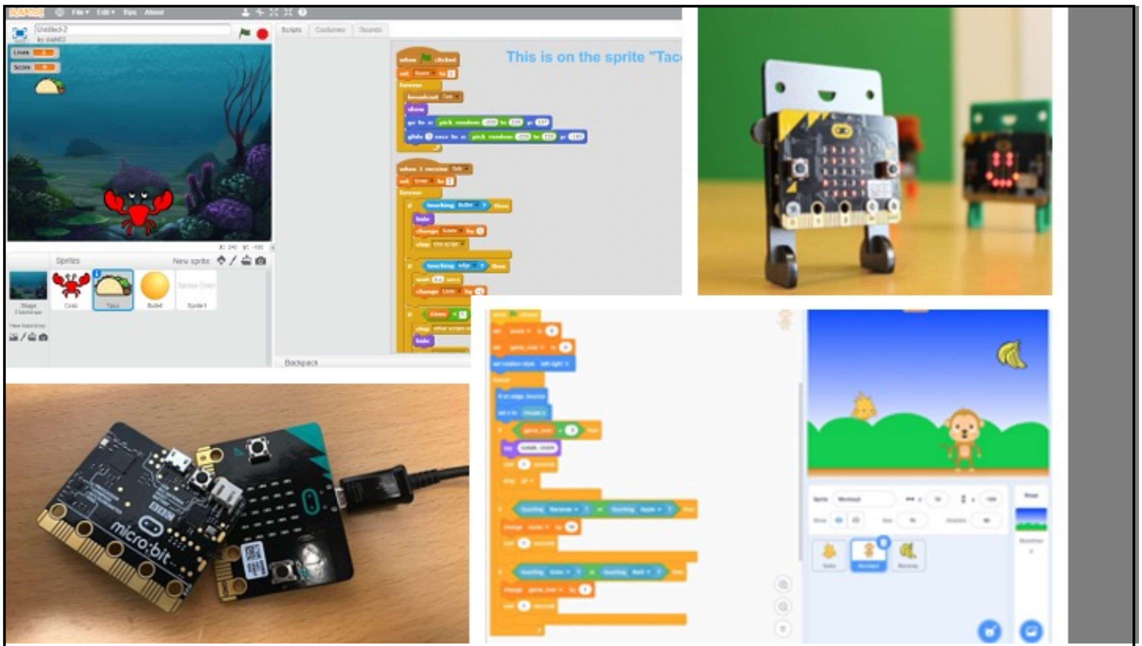

Figure 41. Microbit hardware and two games programming is shown. Block programming allows the programming of both video games and robots. Source: Geeksforgeeks, scratch.mit.edu.

Capsule 2: Microbit unboxing with engines, wheels, and a proximity sensor. In this capsule, the children see different pieces to compose the first robot with a behavior programmed by themselves that interacts with the physical context. Dynamics: 1) Robot brainstorming (YouTube), the consensus of the robot that will be carried out (3-4 options), and the individual and social utility it will have. 2) Robot assembly. 3) Open Scratch. 3.1) Define new logical schemes and controls, and programming. 4) Game. 5) Disassembly.

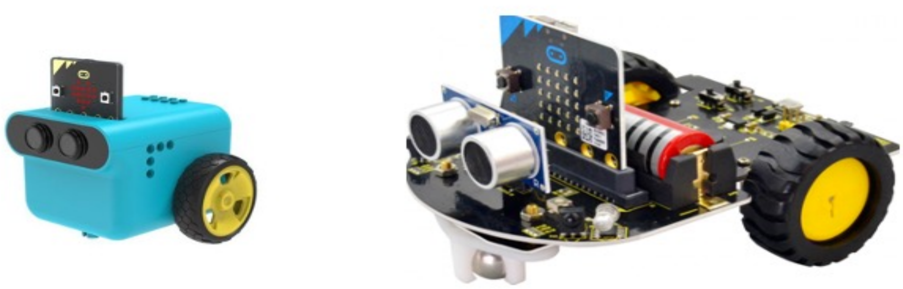

Figure 42. Two kits are shown with capsule two elements. Source: TPBOT and KEYSTUDIO.

Capsule 3: Microbit unboxing with engines, wheels, proximity sensor, light, temperature, two servos, cardboard scissors, and white tail to cut and make pieces, as well as some axes to joint cardboards. Ideas can be taken from to https://cardboard.lofirobot.com. In this capsule, the children of the Pla Comunitari la Verneda i la Pau must think and freely execute different robots in groups of three. 1) Robot brainstorming, the consensus of the robots that will be made. 2) Robot assembly. 3) Open Scratch. 3.1) Define new logical schemes and controls, and programming. 4) Play. 5) Disassembly.

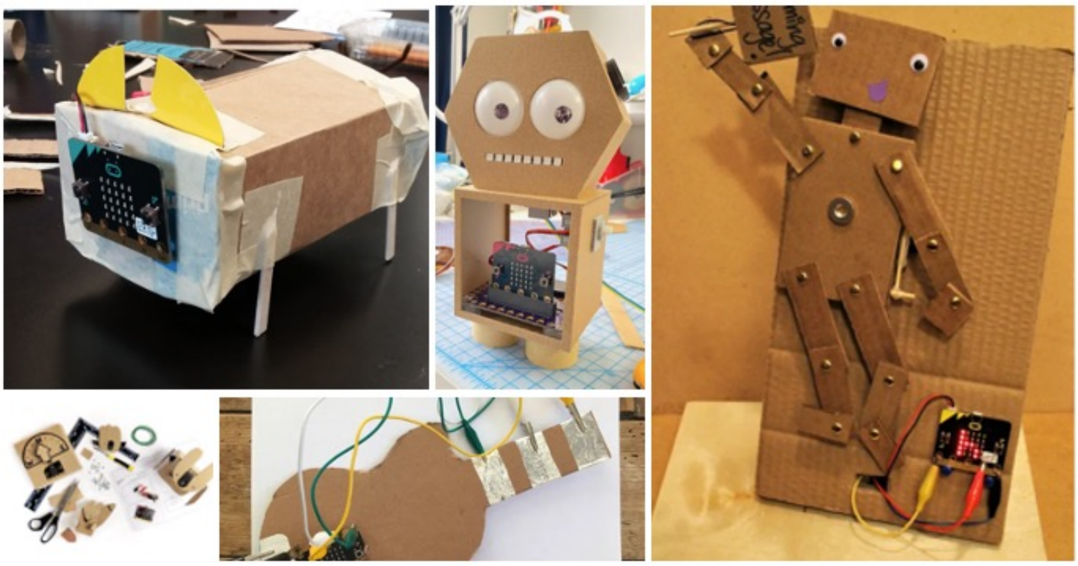

Figure 43. Examples of Microbit with cardboard from the third capsule. Source: Microbit, Mr. Quentin's Center for Advanced Awesomeness, Indestructables.

21.3.4. Pilot cost

Each kit with all the necessary elements to make the capsules costs €61.95 without taxes. One can perform many more experiments with a kit than those proposed above. 8 Kits=€495.60 (Keystudio). Each capsule has the cost of the guide, a purchase voucher of €40 in a robotics store. Two capsules compute a cost of €80 for the guide. It is not merely an economic incentive that helps the guide if is a "maker", because the guide will also learn from kids and is a volunteer. So, the cost of the pilot is €696.48, including taxes.

Once the pilot is finished, the replicability and improvement of the model should have the cost of the guide and some parts that can break (Microbit is quite robust, maybe a cost of 15% for every 10 capsules). Capsules can mutate and become more complex after the kids know them, it will be easy because the Microbit hardware is owned by the Pla Comunitari de la Verneda i la Pau. The better creative the guide, the better the creative the kids.

21.4 Conclusions

The economic benefits of the logic buy and sell experiment fund the pilot and the pillars of continuous STEAM learning in Pla Comunitari la Verneda i la Pau. If the pilot works successfully, perhaps the City Council, University of Barcelona or other third-sector agencies can continue funding the capsules. 40€ (guide) or academic credits in case of any University, plus the broken parts.

The way to cover complexity is with complexity (Bastardas-Boada, 2019), not trying to reduce complexity. This model embraces new complexity and defines new frontiers in complexity; in this sense, it has progressed. Operating in complex markets without controlling complexity increases the probability of losing money. The best way to control complexity in cryptocurrency markets is through algorithms. This is very different from previous stages that the researcher has experienced. As said before, the researcher understands the cryptocurrency markets as a platform for economic experimentation, which is impossible in the traditional economy. The '29 crash provided much information on populism, power dynamics, and bubble practices. Regulations like the Glass-Steagall Act were created to restrict and control access, create filters to prevent this from happening again, and control the economy. The world of cryptocurrencies has allowed the researcher to experience various "cracks of '29", see centralized exchanges crash, and observe massive, uncontrolled, influenced behavior. The researcher has also understood that machines based on DLT, do not fail; people fail.

Using a speculative environment such as stock markets, which is characterized by negative feedback and reversing the feedback from negative to positive by means of financing the pilot of the Pla Comunitari de la Verneda i la Pau, directly, without brokerages, shows that technology allows for important forms of social empowerment. The pilot aims to eliminate the initial economic barrier (the initial hardware investment), which corresponds to the institutions of Fig. (5) (top-down). The fact that the problem is bottom, the initiative is bottom, and the solution is bottom, through a technological tool that shows efficiency and social empowerment, indicates that the thesis argument is not wrong. A set of algorithms from an experiment finances the execution of a pilot so that it can grow through the institutions represented in Fig. (5). This can be expressed in a proto-DAO, which dedicates the benefits of the self-financing experiment to the execution of the educational pilot (externalities). But, supposing that the Pla Comunitari de la Verneda i la Pau uses a set of algorithms to fund the capsules recurrently, it would discuss greater self-financing, self-government, and social empowerment. This solution would respond to Fig. (17), which expresses exponentiality in energy, competitiveness, and complexity. At the same time, this solution would not be a State figure (public) or market (corporate/private) (Ostrom, 1990) but rather a solution from civil society to civil society. Algorithms are science, not owned by the researcher. So, the Pla Comunitari de la Verneda i la Pau could execute one of the logics of the test for self-financing, but there are three critical impediments.

I. The researcher is a sociologist, not a M.S. in Quantitative Finance, so the knowledge is limited, and the logic he has created is not perfect. It may not detect the best moments for buying or selling at the exact point, but it will likely identify when a buying moment begins and sell at a selling moment while controlling losses through stop-loss. Many individuals perform much better with algorithms than the ones the researcher has developed to test. Although fascinating logic can be created using ML schemes, it is a constant task that requires dedication. The Pla Comunitari de la Verneda i la Pau provides neighborhood support, their resources are focused on social integration, not programming algorithms, but it could be possible to merge new disciplines.

II. Although the researcher has conducted a test and obtained benefits, it cannot be solely relied upon as the main source of income for the DAO_{SC} or a neighborhood association. Past yields do not guarantee future yields. Of course, there are investment DAOs that are based solely on crypto purchase-sale algorithms. As previously seen in (Garrod, 2016; Atzori, 2015), and (Riva, 2020), these DAOs would be similar to a Société d'Investissement à Capital Variable (SICAV) or an Investment Fund (IF) in the "traditional" world. The possibility of structuring a social institution like Pla Comunitari de la Verneda i la Pau as an IF or a SICAV to achieve common revenues is an example not only of the opportunities for social empowerment that technology allows but also of the relationship between physical technology and social technology that this research advocate. However, as previously stated, the researcher views Crypto-Finance as an experimentation environment. This is why the researcher considers this kind of algorithm an investment that, in the DAO_{SC} scheme (Fig. 30), would be placed in the investment column (I), with the revenues allocated to specific positive feedback projects agreed upon by all DAO_{SC} members. Nevertheless, creating a social institution whose main financing is algorithms in the crypto world is risky.

III. The execution of the pilot's practice is difficult due to the observations made in section 17 and the management of legal responsibility. How can the benefit of an algorithm owned by "all" (currently six people) be executed if they want to configure a scientific DAO to purchase hardware and gift vouchers for the pilot? It cannot be done. A shared crypto wallet can be created, and wallet transfers can be made between the members. However, the process of purchasing 8 robots and vouchers requires a credit/debit card in the name of an individual, not the DAO composed of multiple members. According to the researcher, a card cannot be associated with a DAO. In this case, all members of the proto-DAO have delegated the responsibility to the researcher who conducted the purchase.

21.5 Pilot execution

With the benefits of automated crypto logic, the pilot education program in science and robotics has been funded at the Casal de la Verneda i la Pau. Microbits (hardware CPU) and kits with motors, sensors, etc. were purchased. The first pilot was carried out on June 20-22 with 16 children aged 8 to 14 (challenge).

1. The objectives of the pilot were:
   - To promote science and technology to children.
   - To help children understand and control technology as if they do not understand or control technology, there is a greater chance that technology will control them.
   - To understand technology through the creation of technology. You learn to create by creating, but to create you need imagination. Children must be able to express and create what they imagine.
   - To understand complexity, to understand the complex as easy. What may seem very complex is easier than it appears (this only arises when you have faced complexity).

2. The method of the pilot was:
   - Cooperative learning, where everyone has the same objective and the same challenges. The guide showed the way, and when the children got stuck in a process and continued searching for solutions, the guide explained the solution to one of the stuck groups, and they in turn went to the other groups to teach the solution. Children internalize the content when they teach what they have just learned. The diffusion and learning of the solution is greater. Learning is much more dynamic.
   - The guide was 16 years old, and the children empathize more with someone their own age. They see themselves more reflected. It establishes a more acceptable threshold for children than a teacher who is older. In other words, "if the guide does it, I will too" vs. "if that teacher does it, maybe I won't (because I don't know what he knows)". This makes learning much more dynamic.
   - The creation of a robot or project is the sum of many processes that must be successful, and the children overcome all challenges (processes) successfully, since they always do. They always "win", and this stimulates them to continue learning and taking on new challenges. This leads to more dynamic learning, as they want to keep learning.
   - It is a group of friends who are building, creating, and co-creating video games or robots.

3. Dynamics:

   - The pilot consisted of two 90-minute capsules.

- In the first one, the children learned what a microbit is, where the gyroscope or Bluetooth is, how to connect it to the computer, they designed a character on the computer, a scenario, and controlled their character in that environment with the microbit. Surprise, the microbit is a video game controller with buttons and gyroscopes. They learned to create their own video game.
- In the second capsule, they connected kits with motors, wheels, and sensors, and the children understood that in the same way they can control a character on the screen, they can also control something physical. Some groups of children created the logic to control the car, and others created the logic of the car. They learned to create a remote-controlled car. We held team tournaments.

4. Results:

- All the children repeated, no dropouts were from one capsule to the other. This is very good. The feedback from some mothers was that their children had not stopped talking those days about what they had done in those capsules.
- The learning dynamic that arises from the method allows these children to do anything they set their minds to. Just as they made a remote-controlled car, they can also make a drone. They have no limits. Much better than I expected, they were very fast.
- In the first capsule, three children asked me for a microbit, in the second, they all told me they wanted a microbit. This was my mistake, although the kits we bought with motors and others cost us 78€ each, a basic microbit is 22€. All the kits we bought are now owned by the Casal, but not by the children. I should have foreseen this.
- They all went home with high self-esteem, they saw that they are capable of creating what they imagine, creating and understanding what surrounds them empowers them.
- The Faculty of Mathematics at the UB will award credits to students to be guides.
- The center's director told me it was a resounding success and they have a budget (City Council + foundations) to continue with the capsules next year. This is something that has been said before, this was done so that traditional institutional actors can take over. But it would be cool if the center developed its own algorithms and financed the capsules.
- We are all happy.

Annex II: Next Steps

This work follows a research trajectory, projecting a line of research and relating theoretical sets for which more questions and challenges arise that must be tested. To validate the entire set, the model must be run. At the time of writing this document, regulations in Europe, except in

Switzerland, Luxembourg, Liechtenstein, and Malta, do not contemplate an institution such as a DAO because, at the legal level, central responsibility is required, and in the DAO, it does not exist, with the responsibility lying over everyone. The activities carried out by the DAO are also labor and economic, incompatible with current labor regulations, which do not allow one to be a worker, client, owner, and investor simultaneously. The optimal approach for testing and executing the model is within a scientific environment, specifically a scientific DAO, in accordance with the research's scientific orientation. Therefore, creating a foundation in Switzerland is considered a means to ensure proper operation. The foundation's organization should begin with establishing a scientific committee, appointing various executives, and delineating different areas responsible for carrying out the project, ranging from the legal department to the development of labels and smart contracts. This structure is akin to that of a start-up but one with a scientific and social purpose.

The research assesses the creation of a Sandbox (Allen, 2019), a controlled test environment, allowing the experiment to be carried out in the EU. In any case, it always implies that all members participate in the investigation. The research proposes a framework composed of a series of smart contracts such as proposing, delegating, validating, executing, or financing that must allow a dynamic capable of developing the theoretical set designed in this thesis. The experimentation environment must allow the execution: A) smart contracts, the technology becomes more mature and affordable. B) the correspondence of the data generated by the model in three dimensions. C) the capture of feedback and its prediction.

Initially, the researcher posited that profits generated by algorithms seen in Annex I could be directed toward social initiatives, such as a common contingency or solidarity fund. Algorithms that engage in the buying and selling of volatile assets are considered high-risk financial instruments. This riskiness and volatility, however, are also responsible for generating profits, and without complexity, the algorithm would be rendered meaningless. Complexity, therefore, is inherent to these types of algorithms. This kind of crypto market automatization requires time and constancy if some DAO_{SC} members could be responsible for this process. This would enable direct social science investment, benefiting all parties involved. The following steps could be one way of the execution:

I. Participation in DAO_{SC} is achieved through the co-ownership of an investment algorithm (being an owner of the DAO), so an investor contributes funds to DAO_{SC}.
II. The first smart contract connects the investor's wallet to the algorithm and transfers the initial investment (t=0). An established period of operation (t=1) is set for the algorithm.
III. At the end of the initial smart contract (t=1), a further smart contract -split- divides the funds held within the algorithm's wallet, transferring 50% to the investor's wallet and the remaining 50% to the scientific project's wallet (DAO_{SC}).
IV. The investor receives a return on their investment, while the scientific project gains income for research purposes.

This way could offer new benefits, including:

- It would allow investors who do not invest in social science due to a lack of economic returns to participate.
- Regardless of their scientific background, any individual can invest directly in science and be part of science.
- Investing in a social-purpose scientific organization is distinct from investing in a corporation.
- The process is transparent, with smart contracts facilitating the transfer and division of funds, and the algorithm engaging in buying and selling. Investors are aware of their investment's purchase and sale and its real-time performance.
- There is no infrastructure required, only code, and people.

But this ends at the same point before, crypto markets are good for experimentation, but relying upon the main money entrance is by a crypto bot is risky. The crypto bot can be related to the investment column (Fig. 30) in the DAO matrix for example.

The model developed in this dissertation, and its application as a Science DAO (DAO$_{SC}$) to execute sOS can also be considered as a Decentralized Science (DeSci)[77][78][79][80] project. Desci.com define tools to fund science, as this research as well. In the DAO matrix scheme (Fig. 30), there is a Structural Inefficiency column, set as 1% of the total costs to split for the first venture capitalists and entrepreneurs, it is an option to develop the main framework of the modules that compose sOS.

Table 1: Logs of the logic. (Fig. 41).

2022-04-05 00:56:14	Wallet 24,064.733 TROY, 0 USDT
2022-04-05 00:56:14	⚠️ Buy skipped: Can't buy, order too small
2022-04-05 00:56:14	⏳ Rsi : overbuy @73
2022-04-05 15:00:00	✓ Rsi : overbuy @73 ➜ @73.34
2022-04-05 15:00:00	⏳ Wait ➜ 04-06 01:00:00
2022-04-06 01:00:00	✓ Wait done. 0.011 USDT
2022-04-06 01:00:00	Sell 100% TROY @ 0.011 USDT placed
2022-04-06 01:00:06	Sell completed : Sold 24,064 TROY @ 0.011 USDT Wallet status: 0.7328 TROY, 270.401 USDT
2022-04-06 01:00:08	⏳ Macd : bullish signal position
2022-04-06 01:00:09	✓ Macd : bullish signal position ➜ histogram : 0.00042473008405289074
2022-04-06 01:00:09	⏳ Rsi : oversell @32
2022-04-11 12:00:01	✓ Rsi : oversell

[77] https://www.forbes.com/sites/johncumbers/2023/04/28/the-desci-movement-will-crypto-really-solve-sciences-biggest-problems/
[78] https://descifoundation.org
[79] https://ethereum.org/en/desci/
[80] https://desci.com/about

	@32 ➜ @28.83
2022-04-11 12:00:01	⌛ Wait ➜ 04-12 00:00:01
2022-04-12 00:00:01	✔ Wait done. 0.007748 USDT
2022-04-12 00:00:01	Buy 100% TROY @ 0.007748 USDT placed
2022-04-12 00:00:06	Buy completed : Bought 34,864 TROY @ 0.007748 USDT Wallet status: 34,829.869 TROY, 0.275 USDT
2022-04-12 00:00:06	⌛ Or
2022-04-12 00:00:08	⌛ Rsi : overbuy @73
2022-04-13 20:00:00	✔ Rsi : overbuy @73 ➜ @78.15
2022-04-13 20:00:00	⌛ Wait ➜ 04-14 06:00:00
2022-04-14 06:00:01	✔ Wait done. 0.008913 USDT
2022-04-14 06:00:01	Sell 100% TROY @ 0.008913 USDT placed
2022-04-14 06:00:07	Sell completed : Sold 34,829 TROY @ 0.008913 USDT Wallet status: 0.8688 TROY, 310.4 USDT
2022-04-14 06:00:08	⌛ Macd : bullish signal position
2022-04-14 06:00:10	✔ Macd : bullish signal position ➜ histogram : 0.0003327563269951035
2022-04-14 06:00:10	⌛ Rsi : oversell @32
2022-04-16 18:00:01	✔ Rsi : oversell @32 ➜ @31.41
2022-04-16 18:00:01	⌛ Wait ➜ 04-17 06:00:01
2022-04-17 06:00:02	✔ Wait done. 0.008536 USDT
2022-04-17 06:00:02	Buy 100% TROY @ 0.008536 USDT placed
2022-04-17 09:26:07	Buy completed : Bought 36,326 TROY @ 0.008536 USDT Wallet status: 36,290.543 TROY, 0.321 USDT
2022-04-17 09:26:08	⌛ Or
2022-04-17 09:26:08	⌛ Rsi : overbuy @73
2022-04-19 15:09:51	ℹ️ Info : User Stop Price : 0.008536 USDT Wallet status: 36,290.543 TROY, 0.321 USDT
2022-04-19 15:09:51	Wallet 36,290.543 TROY, 0.321 USDT Exchange fees : 0.58110736 USDT