

Article

Biomimetic Organisations: A Management Model that Learns from Nature

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Abstract: Since the end of the last century, different approaches for corporate management have been appearing that try to incorporate the social advances that are being produced and disseminated thanks to the greater capacity of communication available through social networks and other traditional avenues. Among the best known are Corporate Social Responsibility, Sustainability, the Circular Economy, and Collaborative Economics. All of them add value to organisations, and all of them have a common characteristic: they are anthropocentric approaches. Our proposal goes a step further: we need a worldview that is capable of placing organisations in a position of continuous learning looking at nature, because it is the best way to integrate into it as a more ecosystem and thus achieve its flowering respecting the once to all the other subsystems that make up the planet: Organizational Biomimicry. This work compares the anthropocentric vision with the worldview at the same time that it offers a guide of the essential steps so that Organizational Biomimicry is the new model of corporate management.

Keywords: biomimicry; biomimetic organisations; corporate social responsibility; sustainability; circular economy; collaborative economy

1. Introduction

Since the Intergovernmental Panel on Climate Change (IPCC) issued its first evaluation report in 1990, many voices have attempted to raise awareness of the importance of caring for the planet on which we live. In 2007, the Nobel Peace Prize was awarded jointly to former Vice President of the United States Al Gore and the IPCC “for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change” [1]. The Pope published the Encyclical *Laudato si'*: On care for our common home [2]. In it, a call is explicitly made: “Moreover, the goals of this rapid and constant change are not necessarily geared to the common good or to integral and sustainable human development. Change is something desirable, yet it becomes a source of anxiety when it causes harm to the world and to the quality of life of much of humanity”, as “the climate is a common good, belonging to all and meant for all” [2] (p. 18).

This is not a concern of only some scientists, politicians, or religious leaders. The social and environmental situation particularly affects young people, who are concerned with social and environmental issues. According to the Deloitte Millennial Survey 2015, 77% of those born between 1981 and 1996 (known as “Millennials”) said that the social vision of their company was one of the

reasons why they chose it to work in, and furthermore, they agree with the demand for more social and environmental responsibility from companies—47% believe that the purpose of a company is to improve its impact in both areas [3]. Another Nielsen study from 2014 showed that 67% of respondents prefer to work for socially responsible companies [4]. In 2019, young people from all over the world have taken to the streets demanding a change in the sustainability policies of countries and large corporations in the movement known as “Friday for Future”.

In fact, sustainable development is a fundamental and paramount objective of the European Union enshrined in Article 3 of the Treaty on the European Union [5]. Sustainable development is understood as “one that meets the needs of the present without compromising the ability of future generations to meet their own needs” [6] (p. 23). In November 2016, the European Commission published a Communication to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions titled “Next steps for a sustainable European future. European action for sustainability” [7]. The Communication explains how the 10 political priorities of the Commission contribute to the implementation of the United Nations 2030 Agenda for Sustainable Development and how the EU will achieve the Sustainable Development Goals (SDGs) in the future.

In relation to priority 5, it is relevant to note is that EU action in the area of Corporate Social Responsibility and responsible business behaviour “encourages the private sector to contribute to the achievement of social and environmental objectives, thereby fostering equitable and sustainable growth and the protection of social rights” [7] (p. 11). However, there is a strong debate on why and how the private sector can effectively contribute to ecologically sustainable societies because “all business entities are dependent to biological diversity and the planetary spectrum of ecosystem services either directly or indirectly” [8] (p. 888). Businesses in particular and organisations in general have a responsibility to work together to create a more liveable, just, and sustainable world: “Sustainable development is a shared responsibility of the European Union, the Member States and all stakeholders. It is a joint agenda for citizens, organisations and businesses in their everyday lives and operations. Society at large needs to ingrain sustainability as a guiding principle in the many choices that each citizen, company and civil society makes every day” [9] (p. 1).

Nevertheless, economic and managerial models are not in a position to respond efficiently to this call for sustainable development because they function with an anthropocentric vision where human beings are the owners of their environment and natural resources are at their disposal. It should not be surprising to anyone that companies are not aligned to the call for sustainable development. Businesses are adding value by offering services that are in demand or by processing a product in a way that allows companies from selling the processed good. Then, the task of business is to serve human demands but not to service nature. The features associated with sustainable development do not fit our current model of the market economy in the current definitions of markets and businesses. These economic and business paradigms have shown themselves to be incapable of providing answers to the global problems of the first half of the 21st century.

Therefore, we must take a further step: moving from that anthropocentric vision (human beings will respect limits in order to be able to save themselves) to a natural vision or worldview (human beings form part of nature, ergo organisations form part of nature and behave as nature does). This worldview is based on two pillars—understanding nature as the supra-system in which all organisations are inserted and conceiving nature as a model, measure, and mentor. Thus, Pauli [10] argues that a solution to the present evils of our economy lies in understanding and applying eco-systemic logic, because “nature exhibits an authentic economy, and an authentic sustainability, all the time”. All organisations that are interrelated in this complex environment must be subordinate to a common strategic objective: to preserve the balance of the whole in order to guarantee the long-term life of each of the organisations and the balance of each one of them within the harmonious whole. As Pauli says [10], “it starts from a simple premise: to use the knowledge accumulated over millions of years by nature to achieve ever

higher levels of efficiency, respecting the environment and creating wealth, and translating that logic from the ecosystem to the organizational world”.

Based on biomimicry—from the Greek *bios* (life) and *mimesis* (imitation)—we present the concept of a biomimetic organisation: an organisation which has nature as a model, measure and mentor. Biomimicry, proposed by Benyus [11] and Pauli [10], has been dealt with previously in the field of economic [12] about critical factors of success and organisational models [13] and as a system for the design and manufacture of products [14], but an analysis of the implications of this management philosophy for organisations has hitherto not been systematically put together in the literature. Taking on this task, this article aims to contribute to the theory of the company presenting the main characteristics of this organisational model and initiating a debate about the future of organisations in this common environment.

The paper is organised in the following way: first, the theory of systems and its application to the field of organisations is retraced. Section 3 is devoted to presenting the model of biomimetic organisation that takes nature as a model, measure and mentor. The fourth section is devoted to developing the main characteristics of this model. In the fifth section, a comparison is made between the various new business paradigms (Social Responsibility and Sustainability, the Circular Economy, the Collaborative Economy) and the proposal for biomimetic organisations. The paper ends by presenting the main conclusions that can be drawn when incorporating the biomimetic model both in the academic field and for business management.

2. The Company as a System

According to the Merriam–Webster dictionary, a system is defined as “a regularly interacting or interdependent group of items forming a unified whole” [15] (p. 670). Systems are characterised by the combination of interrelated parts or elements, in such a way that they are interdependent. The systemic nature of companies has been assumed since the middle of the 20th century [16]. That is, the company is conceived as a system and, specifically, as an open system [17].

Systemic thinking raises the need to study the whole and its parts. Regarding teamwork, for example, O’Connor and McDermot [18] showed that the good functioning of the team achieves better results than each person separately, thus generating positive synergy. In the same way, the behaviour of a person is conditioned by the environment in which they operate, so that one cannot objectively evaluate the behaviour of an individual without studying at the same time the system in which they are immersed. It can therefore be concluded that the structure of a system influences the behaviour of its members. This leads to a rethink of the ideas of cause and effect: it is the relationship between elements that turns them into causes or effects, and this relationship depends on the structure of the system. A complex system cannot be controlled; we can only learn to influence it [19].

Using the systemic approach allows us to better understand the movements and interrelations that occur within the organisation and between the organisation and its environment, as occurs in nature, given that in both cases we are talking about something “alive”. Throughout this work, we will consider the organisation as a living system for two fundamental reasons: firstly, because it is composed of living beings, the people who make up the “organisation system”; and, secondly, because that organisation behaves like a living organism in the sense that it is born, grows, relates, learns, rectifies, etc.: “a geologist will tell you that one stone is young while another is old. Astronomers refer to stars as young and old. Granted, lifecycles differ in terms of length—a butterfly’s lifecycle is one-day long. A star’s lifecycle may last millions of years. Organizations, too, have lifecycles: they are born and grow, and, unless management knows what to do, they age and die” [20] (p. 8). Indeed, there is a huge tradition in both economic and management literature about corporate life cycles [21,22].

Understanding the company as a living system implies that, although we break it down into simpler parts in order to analyse them, we must understand the relationships between the various parts if we want to understand their results. The main component of organisations, the human being, is a social being by nature [23]. There are different views of human nature and these beliefs about the

nature and purpose of human life are often embedded in different ways of living, in political systems and in economic models [24]. For example, the “*Homo economicus*” described by Adam Smith in *The Wealth of Nations* [25] is the foundation of classical economic theory and consequently of the capitalist system in which we operate. However, this conception of human nature has been criticized from many scientific perspectives (psychology, economics, ethics,...). The bounded rationality approach [26,27], for example, has a particular impact on the inability of human beings to dispose of and rationally process all available information. Similarly, behavioural economics [28] underlines the importance of emotions in decision-making. For McIntyre, the human being is rational and dependent, and so is rational and dependent [29]. It is dependent on other human beings and the environment in which it develops. For this author, human beings can be better understood if the types of beliefs and behaviours they share with other intelligent animal species, such as dolphins, are taken into account and if it is understood that human actions and beliefs develop from those shared traits and that, to some extent, they always depend on them [29].

The systemic analysis of organisations implies that relations with the environmental supra-system in which the organisation is immersed must also be analysed and understood. The globalisation of the economy requires the consideration of the relationship of the company with its environment in global terms and not only in relation to the specific environment of the organisation. From this worldview, Wheatley [30] argues that many scientists now try to understand “life as life”, moving away from images of the machine. For example, in *The Web of Life*, Fritjof Capra [31] presents a new synthesis of the science of living systems, which brings together scientific discoveries and theories that form many branches of science. Capra’s synthesis reveals processes that are surprisingly different from the mechanics that were used to explain life. In short, the systemic approach and worldview allow organisations to be understood as bio-organisms immersed in a global environment.

In this transition from a view of the organisation exclusively as an open system (anthropocentric view) to another view where organisations are living organisms immersed in a global ecosystem (worldview), we can find different models of organisations. According to the anthropocentric view of the company, the natural environment is at the disposal of companies, which obtain from it the resources they need for their productive process. Management of resources focuses on ensuring their availability for the productive chain (current and future), but not on the intrinsic value of these resources regardless of their economic use.

On the other hand, the biomimetic model—which we present below—considers nature as a commodity in itself. Therefore, this must be taken into account over and above its productive use. Benyus [11] notes that economies are like ecosystems—both systems take energy and materials and transform them into products. The problem is that our economy carries out a linear transformation, while that of nature is cyclical. To try to prevent the current economic system from persisting in the linear model, the Circular Economy advocates a circular system based on the following three key principles: preserve and improve natural capital, controlling finite stocks and balancing the flows of renewable resources; optimise the use of resources; and reveal and eliminating negative externalities [32,33].

3. The Biomimetic Model—Nature as a Measure, Model, and Mentor

When we look intensely at nature, we “realize that all our inventions have already appeared in nature in a more elegant form and at a lot less cost to the planet” [11] (p. 6). According to Swan and Swan [34], over thousands of years, nature has been building ecosystems that, starting from barren soil, have been able to develop harmoniously and interact with other ecosystems in such a way that the planet has extremely efficient and beautiful “self-regulating forces”. MacIntyre [35] recommends, in relation to our obsolete and destructive production and consumption systems, that we look at the adaptive skill of nature.

The time has come to learn to be inspired by the wisdom of nature to create new values and cultural systems. The model of biomimetic organisation, therefore, has as leitmotiv nature as model, measure, and mentor.

Nature as model: Biomimetics is a new science that studies the models of nature in order to imitate or be inspired by biological designs and processes for solving human problems. In this sense, Benyus [11] encourages us to see nature from another perspective, and this is key: we do not look at it in order to extract its fruits, manipulate it, “improve it” or transform it in a thousand different ways; we look at it to learn how to behave like it, because we are part of nature itself. Capra [36] (p. 10) expresses it this way: “The outstanding characteristic of the biosphere is its inherent ability to sustain life. To be sustainable, a human community must be designed so that its ways of life, technologies, and social institutions honour, support, and cooperate with nature’s ability to sustain life”. Thus, Kennedy [37] points out that the aim of biomimicry is not to provide a copy from the nature, it actually focuses on principles and adapt to companies’ needs.

There are numerous examples of companies that have incorporated ideas inspired by nature into their systems or processes. Benyus [11] offers brilliant solutions—fibres that imitate cobwebs (five times stronger than steel and very elastic), solar cells capable of converting light into energy, a pharmacopoeia based on the ancestral wisdom of chimpanzees, or intelligent computers composed of biomolecules. More recent are applications such as swarm robotics (see an example of virtual ants in Campo et al. [38]).

Nature as measure: After billions of years of evolution, nature has discovered what works, what is suitable and what endures. Biomimicry uses an ecological standard to judge the correctness of our innovations. It deals with, first of all, measuring the social and environmental impact of the decisions of organisations. These measures provide important and valuable information that allows managers to more accurately assess the repercussions of impacts that result from business decisions [39].

There are different approaches for identifying and measuring impacts on the nature of products, services and activities of organisations—cost of control and fixing of shadow prices, cost of damages, market price and valuation, hedonistic fixation of prices, travel costs, and contingent valuation (a description of the main methods can be found in Epstein, 2008 [39]). Measuring these impacts, monetising them, and including them in managerial decisions allows for better cost–benefit analysis, as well as better decisions both for the social benefit of the groups involved and for the long-term profitability of the firm.

In the last decades, a multitude of indicators or measures have emerged that try to facilitate the communication of the different social and environmental impacts caused by the activity of the organisation to the stakeholders of each company—the Global Reporting Initiative (GRI), the Global Impact Investing Network (GIIN), ISO A1000, etc. What characterises these impact indicators is that they are voluntary and, despite their systematisation, incomparable. It is the abundance of guides that presents companies specializing in greenwashing with the possibility of showing the friendliest face of their activities, since they can choose to adopt the guide that best highlights their achievements and disguises those points in need of improvement.

Taking nature as a measure also means taking into consideration the intrinsic value of nature with which the organisation relates. This intrinsic value, also called existence or conservation value, is independent of the present use that people make of resources and arises from the sense of environmental management related to responsibility for the preservation of natural resources for future generations [39]. Even if a resource does not have any value in use that is clear at the present moment (use value) or in the future (option value), people may be willing to preserve that resource given that they consider that it has the right to exist and should be protected [40].

Nature as mentor: Biomimicry is a new way of contemplating and valuing nature. It begins an era based not on what we can extract from the natural world but on what it can teach us. Hawken [41] has already advocated that our destiny as people is inevitably linked to what happens to all other living beings. Vogel [42] highlighted the affinity of people for nature; a mechanism that helps to bring out

the feeling of natural rectitude and moral superiority in the way nature does things. In the words of Rogovsky [43] (p. 6), biomimicry “not only offers organisational parameters and provides examples of what works and what does not, but also converts nature into a type of mentor that offers a new way of appreciating it and of considering human organisation”. Celep et al. [44] stress some aspects of management that can benefit from the biomimetic approach, such as leadership, innovation, strategy, and corporate structure.

Benyus [11] points out that other non-human living beings learned a long time ago that “polluting the nest” is a ruinous business and that nature already discovered all our inventions a long time ago, putting them into practice, furthermore, in a way that is not costly for the planet. For this author mature ecosystems are formed by different beings that pursue common purposes (like us)—maintaining their presence at a site, making the most of what is available, and surviving in the long-term. Organisms in a mature ecosystem [11]

1. Use waste as a resource;
2. Diversify and cooperate to fully use the habitat;
3. Gather and use energy efficiently;
4. Optimize rather than maximize;
5. Use materials sparingly;
6. Do not foul their nets;
7. Do not draw down resources;
8. Remain in balance with the biosphere;
9. Run on information;
10. Shop locally.

Next, we present the elements of these mature systems and the way in which these characteristics are adapted to determine what is meant by biomimetic organisation.

3.1. Use Waste as a Resource

On Earth, there are numerous organisms that feed on the waste of others (such as vultures or hyenas), and ecosystems of organisms that break down complex organic matter and molecules into smaller molecules that can be used and reassembled into completely new materials. For example, in sediments, there are several types of bacteria that develop and depend on the various organic compounds in their environment, leading to a level of specialization for degrading organic matter and thus favouring the fertilization of these sediments [45].

In the field of organisations, the Circular Economy movement presents production as a cyclical flow, which involves extracting, transforming, distributing, using and recovering materials and energy from products and services [46]. This is about “producing resources, not waste” [32]. In Finland, for example, Sitra (the Finnish Innovation Fund) already has the role of catalyst for the transition to the circular economy and has developed the innovative road map for the circular economy of Finland 2016–2025 with the cooperation of more than 1000 participants from all sectors of society defining a common agenda. Following this strategy of avoiding waste, Benyus [11] notes that we are now talking about biopolymers, vegetable plastics, and biofuels as different ways of replacing rare and precious products with others that we can make from the energy that the sun gives us.

Regarding the management of people, some organisations are beginning to consider how to preserve and give meaning to the activities carried out increasingly by older people [47], copying from nature with respect to the distribution of responsibilities in different generations [48], in order to improve the situation of senior employees [49]. There are also very praiseworthy initiatives in the market to favour the inclusion of people with labour difficulties, such as the Adecco Foundation’s guide “Muy válidos para el empleo” (Extremely Valid for Employment) [50].

3.2. Diversify and Cooperate to Fully Use the Habitat

In nature there are numerous cases of symbiosis: close relationships between different types of organisms in which all individuals benefit from the relationship. For example, Martínez and Pugnaire [51] talks about the important role played by organisms that live in the soil and interact directly or indirectly with the plant community.

In the world of the organisation, there are many cases of entities that offer fair trade products to an increasingly demanding and aware public, so that both customers and producers in developing areas benefit from this approach [52]. According to Austin et al. [53], organisations strive to achieve a competitiveness model based on their ability to adapt and respond to environmental stimuli, often establishing alliances to achieve this. Schann et al. [54] goes into great detail explaining that alliances between organisations tend to be flexible, with a low level of risk and able to design frameworks of mutual benefit. This tendency is observed in different sectors of activity, and according to Renart [55], alliances are forged also taking into account what the appropriate size should be (with respect to other existing alliances in the market) and whether their own alliance is more or less powerful, active, organised, effective, and stable than the alliances of their competitors. Schann et al. [54] lists the following main characteristics of alliances between organisations: (1) each of the organisations that form the alliance remains independent; (2) all of them share the benefits that are achieved thanks to the cooperation agreement, by controlling the performance of the tasks assigned to each; and (3) each of the organisations in the association contribute their effort to one or more pre-agreed areas (for example, technology, production, etc.).

Partnerships can also be made with one of the stakeholders—Laseter et al. [56] focused on supplier policy as a source of mutually beneficial relationships, cooperating with the supplier in difficult times so that both parties reach their joint medium-term goals. In Spain, the supermarket chain Mercadona has a symbiotic relationship with suppliers included in its new *totaler* system implemented in 2019, which basically proposes a long-term relationship with these suppliers, product development through co-innovation, indefinite contract for the product, quality product and competitive price and, in case of disengaging, only focusing on the product. It now offers its 1400 specialist suppliers indefinite agreements, mutual profitability, and maximum quality with a focus on food safety. In the words of Juan Roig, founder of the chain [57]: “We have to produce the products that the boss wants (“the boss” is what they call the customer in Mercadona). We have invested three million in 2018 in Mercadona and developed 300 new products as a result of co-innovation processes”.

Based on the lessons that nature offers us, the cooperative strategies of a symbiotic company would be: evolutionary innovation based on cooperation and mutual benefit; change management based on small successive modifications; constant interpersonal communication based on pre-established and “elastic” guidelines; and management of the internal ecosystem based on ethics and values such as respect and mutual benefit.

As a mutually beneficial agreement, companies have proposed cause-related marketing for some time, defined by Kotler and Andreasen [58] (p. 304) as “any effort by a corporation to increase its own sales by contributing to the objectives of one or more non-profit organizations”. These approaches, if they are not well designed and transparent, can have double readings. Olivares [59] warns that cause-related marketing can be understood as “solidarity blackmail”.

3.3. Gather and Use Energy Efficiently

Organisms spend energy, basically, while obtaining energy (photosynthesis, search or capture of food) and in the cultivation of materials that form part of their body and their home. For this, they have different strategies designed, all of them tending to need the minimum possible energy to obtain the maximum possible results (for example, phototropism, hunting techniques, construction techniques, multifunctional designs, etc.).

Similarly, the biomimetic organisation uses “clean” or “green” energies as much as possible. But the concept of energy saving also applies to all corporate strategies and policies, for example,

simplifying processes and procedures, bridging hierarchical levels, designing new ways of using space and resources, etc. We can observe it in the application of distributed leadership in the management of work teams [60] and telework that, in certain circumstances, drastically reduce travel and cost, recruit talented employees, engender creativity and originality among team members, create equal opportunities in the workplace, and discourage age and race discrimination [61].

3.4. *Optimise Rather than Maximise*

Eguiguren Huerta [62] warns of the dangers of maximising production at all costs, highlighting that globalisation is generating a volume of transport at planetary level that causes inadmissible levels of CO₂, with a consequent impact on climate change and environmental sustainability. Nature, on the contrary, tends to optimise rather than maximise, given that both materials and energy have a high cost. Miller [63] points out a good example of optimal communication—he looks to starlings to understand how they optimise their movements in a murmuration, following their six or seven closest companions as collecting more information simultaneously from more individuals generates noise and inaccuracies that may affect survival. For his part, Wilson [64] refers to various animals expert in optimising materials—the nests of fish eagles and swallows and the dens of muskrats, beavers, and badgers persist for several generations.

Applying this logic, Pauli [10] proposes that one way to solve the problems of our current economy is to use biomimicry, because nature is an expert at economics. Thus, to generate employment for the citizens of this century, he proposes a model based on “eco”-facture (doing things in a respectful way with nature), instead of the “manu”-facture (doing things in the most cost-effective way possible). Cuatrecasas Arbós [65] shows that organisations apply efficient management systems based on tight production, focusing on using the minimum possible resources in the best possible way, and giving rise to the management system we know as Lean Management. According to Martínez-Jurado and Moyano-Fuentes [66], companies that apply Lean Management not only achieve better results, but also manage their businesses responsibly and are aware of the impact their activities have on society. For example, the Toyota production system (TPS) guarantees lower costs, higher quality, better service, greater flexibility, and more innovation [67]. TPS is based on Lean Management, or process management seeking perfection. It also applies to sectors outside the automotive industry; Inditex (the textile company) is an example.

3.5. *Use Materials Sparingly*

Nature builds normally from the most common and readily available elements—carbon, nitrogen, hydrogen, and oxygen. They are elements used for the construction of the organism of a living being (a wing, a horn, etc.) or for the construction of nests and dens. In the case that scarce elements are used, they are always available within the radius of action of the living being—organisms do not travel distances to obtain them. For example, storks incorporate plastic and other debris into their nests, which they find at hand, and hermit crabs use empty shells to protect themselves, which they find in their environment [68].

In the world of the organisation this principle can be applied by making products with raw materials, which are geographically close by instead of favouring intercontinental transport. A good example is Kalundborg (Denmark), which came about randomly but later became one of the most complete experiments in industrial symbiosis worldwide [69].

3.6. *Do Not Foul Their Nets*

Nature uses chemical processes and materials that are safe for living beings, and when the manufactured substance is no longer necessary, it degrades so that it can be used by other beings or it can be reintegrated into nature to form part of a new life cycle.

In the world of the organisation, it is increasingly common to consider how to minimize chemical risks in manufacturing processes and throughout the supply chain, as well as utilising materials that

can be reused at the end of their useful life. For example, the material known as TAMOC, developed by a Spanish company, comes from the recycling of carpets from buildings and vehicles. It is a light and decorative material for construction, which has acoustic and thermal insulation properties and is 100% recyclable.

The organisation can also apply this principle to intangible elements that are vital for the sustainability of the system. For example, with regards to the application of sanctions on employees and suppliers, these will be the minimum essential, and in their proper measure so that they help to correct the detected deviation without causing great damage to people or processes.

3.7. Do Not Draw Down Resources

In general, nature uses the best form to accomplish corresponding functions, instead of squandering materials and energy. For example, the jaws of crocodiles can bite at high speed but are also sensitive enough to transport young crocodiles.

Biomimetic organisations can imitate nature by designing multifunctional bodies, such as a team responsible for internal audits and collecting suggestions for improvement or persons responsible for a delegation who are both responsible for the human capital and the management of the suppliers of that delegation, etc. In order to try to enrich a job, some companies periodically review the design models of jobs to favour the enrichment of the employees and, therefore, their versatility [70]. The use of space can also be managed in order to be multipurpose, from a multipurpose room to shared offices.

3.8. Remain in Balance with the Biosphere

Nature is resilient to setbacks—that is, it overcomes significant and unforeseeable changes in the local environment (such as those caused by fire, flood, or blizzard) by addressing them in one of three ways [11]: diversity, redundancy, and decentralisation. Diversity refers to offering different behavioural, physical, or physiological responses; redundancy refers to the fact that there is more than one representative system, organism or species that provides each function, and there is overlap so that the loss of or decrease in a representative does not destroy the entire system; and finally, through decentralisation, the mechanisms that maintain these functions are dispersed throughout the system, so that a localized disturbance does not eliminate one or more vital parts of the system as a whole. Green, Leigh, and Lee [71] applied this idea to the world of water management using a new engineering model whereby “through strengthening individual components, resilient systems attempt to retain and rapidly reinstate system functionalities after failure, through flexibility and diversification of functional dependencies” (p. 3).

Organisations that apply the principle of diversity are concerned, among other things, with addressing complaints and suggestions from their participants (employees, customers, suppliers, the social environment, etc.). For example, in response to social pressure, trade moves from offering plastic bags to paper bags. Other organisations are redefined to offer different products/services based on the data they perceive from the market. One example is Nokia, manufacturer of mobile phones until 2014, when it sold the division to Microsoft; it is now a developer of connectivity solutions for government companies, in addition to being responsible for the business core of a Shared Network in Mexico. Kodak has moved from seller of photographic material to manufacturing materials for equipment and services in the graphic printing market. Siemens has gone from being a mobile phone manufacturer to diversify its business, now manufacturing products for the industrial, energy, and health sector. Fujifilm has gone from the photographic business to developing solutions that drive medical systems for endoscopy, imaging, ultrasound, in vitro diagnostics, and technical services. Apple has just announced in 2019 that it will enter the world of television and credit cards so as to not depend solely on the sale of mobile phones and computers. The idea of diversity is also applied regarding the management of human teams; in fact, there is evidence for several benefits derived from effectively managing diversity [72].

Biomimetic organisations apply the principle of redundancy to reinforce key aspects. For example, making sure that people in management positions know in depth the vital procedures of the organisation (by sending them to the production plants or the points of sale to make sure that everyone knows the key points for the success of the business); custody of data by making backup copies; process manuals, ethical codes, and other informational documents delivered to all employees; or succession policies for key positions. In this regard, ISO standards emphasize making sure that everyone involved in a process or procedure always has the latest update of that process or procedure.

Organisations use the decentralisation resource in different areas; some examples being distributed computing [73], collegiate directorates [74], and multidisciplinary teams [75].

3.9. Run on Information

Both organisms and ecosystems need to receive information from the environment and be able to act appropriately in response to that information—they exchange information with the environment, with other organisms and with themselves. They need, at least, to detect and respond to conditions close to their limits (maximum temperature, oxygen level, distance from predators, etc.). They frequently use negative feedback loops (the variation of an element propagates along the loop in a way that counteracts the initial variation) and positive feedback loops (the variation of an element propagates along the loop in a way that reinforces the initial variation). As Benyus [11] suggests, what we need is to establish retroactive links between and within companies, as well as a retroactive control of these with the environment.

Organisations need to design their communication strategy carefully attending to all stakeholders, and, above all, analysing the responses obtained in order to implement improvement measures that address the 10 key points of the mature system. Particularly important are the internal communication policies within the organisations, basic for managing stakeholders' information in a respectful way and essential to provide a conceptual framework for the study of communication during organisational change [76]. Currently, this effective communication with stakeholders is a fundamental part of the Corporate Social Responsibility strategy of organisations [77].

3.10. Shop Locally

Nature is in tune with the local environment and is sensitive to the environment. There are animals that adjust their life to the rhythm of the tides—mussels and goose barnacles hermetically close themselves at low tide, keeping a little water inside; sea otters that wrap themselves in seaweed so that the tide does not move them; on dry land, the chamise produces inactive seeds that need fire for germination, thus adapting to the adverse cyclical conditions of its environment. Organisms use these predictable cyclical patterns as an opportunity, thus occupying a niche that other beings cannot take advantage of.

The ability to respond to these changes, using them as opportunities, allows organisms and ecosystems to thrive. The same thing happens in organisations: Eguiguren Huerta [62] thinks that the failure of organisations is basically due to their inability to adequately read the environment in order to improve through renewal and reinvention.

Organisations attentive to social and environmental changes can occupy an empty niche that presents an opportunity for sustainable development: for example, organisations that offer shared transportation (BlaBlaCar), shared homes (coHousing), or sale of items for organisations (SoloStocks). In this sense, the social entrepreneurship model increasingly has a greater economic and social impact—processes designed to exploit innovation that explicitly addresses complex social problems [78]. In order to adapt to the tastes of potential customers in different markets, there are wine companies that use tools such as Just About Right (JAR) [79].

4. Characteristics of the Biomimetic Company

For Robbins and Coulter [16] (p. 6), organisations are “a deliberate arrangement of people to accomplish some specific purpose”. From this definition we can extract the three characteristics that all organisations share. First, each organisation has a different purpose; second, every organisation is composed of people; and third, all organisations use certain means to achieve the purposes that have been proposed. The previous analysis of mature systems allows us to conclude that a biomimetic organisation is characterised by the following elements.

4.1. Ends

Melé [80] believes that the ends or purpose of the organisation refers to the role of the organisation in society and its social and ethical justification. From this point of view, Cortina [81] points out that organisational activity is developed to earn money, but not only to earn money; it is more than a business, it is first and foremost a human group that pursues a project. The description of the organisation as a human group with a common objective fits well for all the approaches we have called of “anthropocentric view”.

The purposes of biomimetic organisations are extended to include the ecosystems of the planet. That is, the organisation defining objectives, strategies, policies and processes as a part of nature in which it is integrated. Thus, Benyus [11] highlights that, in relation to the ends of organisations, “the only answer is an industrial ecosystem that can dovetail with the biosphere without harm” (p. 272).

In the same way MacIntyre [35] understands that, following Moore, he wonders “What kind of actions ought we to perform?” and his answer is: “[Those] which will cause more good to exist in the universe than any possible kind of alternative”. Causing more good is not something that we consider as the first option. Wilson [64] believes that we share with other vertebrates a tendency towards discord and aggression, and—nevertheless—we have managed to overcome it by acquiring intelligence to learn about the past and better define the future. We are thus able to establish contracts that last for generations based on reciprocal altruism. A traditional example is the exchange of food, which co-evolved with brain development and a long period of juvenile dependence [82,83]. It seems that this capacity to establish ties of cooperation has been between us from practically the beginnings of human societies. From bands to tribes, from tribes to states, humans establish systems of links that go beyond typical interpersonal relationships—we design alliances and economic agreements. In this complex world today, interactions are very diverse, but they are still based on moral rules that have barely changed; in fact, we behave according to a formalized code very similar to that applied by less complex societies, such as hunter-gatherers [64].

4.2. Means

To understand the proposal of biomimicry on the relationship of organisations and nature, we will follow the argument made by Guillén Parra [84] when he describes the three “Es” in the nature of the organisation: effectiveness, efficiency, and ethics. For Guillén Parra [84] (p. 65), a human organisation is “a group of people, who come together to achieve common goals, through some means, tangible or intangible, which is more or less stable”.

From this definition, the constitutive aspects of the very nature of the organisation can be extracted: effectiveness, efficiency, and ethics. As in any organisation there are certain ends, goals or objectives, we can talk about organisations being more or less effective to the extent that they achieve their goals. In the same way, an organisation can be qualified as more or less efficient to the extent that they achieve better results with less means. Finally, since organisations are made up of people, we can qualify them as more or less ethical, insofar as they contribute to the human development of their members and those they serve [84]. Incorporating ethics as an integral part of the nature of the organisation is decisive in understanding the character of organisations, because ethics “not only looks at the results of the action, but at who carries it out” [84] (p. 67). It is crucial to separate ethics, effectiveness and

efficiency as different dimensions. All three are necessary for the survival of the organisation but distinguishing them allows us to understand that people are not the “means” of the organisation, they are ends in themselves [85], and therefore they should not be valued exclusively in relation to efficiency. The people in organisations have dignity and the organisational dimension that allows it to be managed in organisations is ethics, insofar as it values their development as a human being. In the same way, in biomimetic organisations, nature is not considered a “means” for the achievement of organisational ends but must be treated according to the dignity it deserves. In biomimetic organisations, the natural resources with which the organisation is provided have their own role as part of nature with which we identify ourselves. “The biomimetic organisation is a super-organism composed of people “giving their best”, understanding and adapting to the needs of others around them, which in turn is part of a higher entity that generates properties different and more complex than the sum of the parts” [43] (p. 6).

From the analysis of mature systems presented above, it can be inferred that biomimetic organisations present light and even fluid structures, multidisciplinary teams working on projects, value management, ecosystem vision, investment in R&D focused on nature, and distributive and ethical leadership.

4.3. People

People are, among many other things, animals. It is a characteristic that we have tried to hide or forget for many years, but in the 21st century, we are beginning to look at nature (even if only because of selfishness) and we have realized that non-human animals, with whom we share so many things, are a source of learning that can help us not only to return to nature, but to discover what characteristics we share with them which can work to achieve success in the subsystems in which we live.

MacIntyre [29] starts from the basis that we can understand people better if they are thought of within a broad circle formed by other intelligent animal species, since there are a series of shared features. In fact, Benyus [11] goes beyond intelligent animals—she is convinced that if we try to learn from nature, our relationship with the living world changes. Some of the characteristics of people who work in biomimetic organisations can be drawn by observing the behaviour of other natural organisations.

Thus, Miller [63] recommends flexibility, copying intelligent herds that are experts in processes of adaptive mimicry, self-organization, diversity of knowledge, and indirect collaboration. In this regard, the importance of communication abounds, in the wake of results obtained in investigations carried out in engineering, biology, and social sciences; the aforementioned processes stimulate a series of behaviours that we associate with centralised cognition. For example, schools of fish, reindeer herds, and other groups of diverse species have taught us that caring for individuals in the group can be a source of collective intelligence, an effective way to obtain information that would not be obtained by any of the individuals in isolation. Collaborative economy processes, based on collective intelligence such as Linux or Wikipedia, are practical examples of flexible organisations based on shared knowledge.

Sol et al. [86] consulted research conducted on more than 1000 species of birds to find out what capacity for creativity and innovation they have, revealing that the longer they live, the greater their capacity to innovate and to have a generalist ecology. Being long-lived means having a long period of maturation (which entails the possibility of developing a larger brain) and being a generalist means being able to face new challenges (which stimulates capabilities for exploration, discrimination, manipulation and recall).

Wilson [64], on the other hand, focuses on the generosity that has been discovered in certain animal behaviours: macaques, rhesus, baboons and anthropoid apes form mutual aid teams, while chimpanzees, gibbons, African wild dogs and wolves also offer food reciprocally. He also obtained valuable information from insects regarding commitment and altruism: in the nests of certain bees and certain ants there have been found individuals with a very high capacity of work with respect to their congeners, who also exhort others to behave in the same way by means of congratulations.

According to the information provided by MacIntyre [29] regarding cooperation, dolphins of several species achieve a good life because they have been able to establish concerted strategies (with members of their group or with others) to accomplish their objectives.

If we want a biomimetic organisation to count on its Internal Ecosystem with people endowed with the aforementioned characteristics, it is necessary to provide the means for relying on leaders capable not only of having them, but of self-evaluating and committing themselves to continuous improvement. Leaders who are capable of directing the common project that is an organisation [81].

As indicated by Melé [80], ethics must be at the base of the management of organisations, and therefore in their leaders: in order to make decisions adjusted to morality, to shape management style, in order to strengthen its own virtues, to implement good practices in the organisation and to exercise an appropriate model of leadership. Ethical leadership is defined as “the demonstration of normatively appropriate conduct through personal actions and interpersonal relationships, and the promotion of such conduct to followers through two-way communication reinforcement, and decision-making [87] (p. 120). An ethical leader manifests behaviour in accordance with regulations through personal actions, interpersonal relationships, and promotion of such behaviour to followers through two-way communication, reinforcement, and decision making [88]. An ethical leader is a person who exhibits qualities such as honesty and trust, cares about people, and listens to their contributions. In that sense, the authors of reference [87] specify that the ethical leader, in addition to showing behaviours in accordance with the regulations, encourages the incorporation of said behaviours in the interpersonal relations of the people of their team and does so basically through two ways, the reinforcement of appropriate behaviours and disincentives to behaviours that are outside the regulations.

A leader who acts ethically and sustainably is not only behaving morally well but can also be very profitable—in economic terms—for the organisation and its shareholders [62]. In fact, ethical leadership has been positively related to the psychological well-being and job satisfaction of employees [89,90]. When favouring a climate in which employees are supported psychologically, adequately designing roles and verbally recognizing achievements, employees perceive that corporate culture allows sincerity at work, and as a result they feel a positive effect associated with psychological well-being. Ethical leadership has also been positively related to organisational commitment; affective commitment; normative commitment, citizen’s organisational behaviour; and work performance, work commitment and organisational identification [91].

Eguiguren Huerta and Barroso García [92] specify that in an organisational ecosystem there are a series of symbioses that entail behaviours of respect, austerity, responsibility, and proactivity and which are clearly observable in all its members. That is why the leader is expected to be responsible and committed to others, honest and trustworthy, proactive and altruistic.

There is no model of a biomimetic leader in the literature, nor is it the object of this paper to determine their characteristics, but the previous ideas serve as a presentation of their characterization as an ethical leader that recognizes part of the natural system with which they relate—and learn from—in order to obtain mutual benefit.

In summary, as Rogovsky explains [43] (p. 6) “in a biomimetic model, the organisation is effective both at the level of leadership and resource use, as well as at knowing to scan its environment to procure and maintain mutually beneficial alliances. It is part of a system, a network, that acts together to achieve their strategic objectives”.

5. The Biomimetic Company and the New Management Approaches

In the last few decades, different management approaches have appeared in the business landscape that, with different ideological perspectives, try to propose practical solutions to the business challenges of the 21st century. These approaches are: Corporate Social Responsibility and Sustainability; the collaborative economy; and the circular economy. All of them are broad themes that include several approaches related to different disciplines and topics. Next, we present very briefly each of them to show the similarities and differences with the biomimetic model presented previously.

5.1. Corporate Social Responsibility and Sustainability

Although they have differentiated theoretical and historical origins, in practice both theoretical frameworks are embodied in management systems oriented toward the so-called Triple Bottom Line [93]—economic viability, social responsibility, and environmental sustainability. In this way, the results of the organisations are measured not only in financial terms, but also due to their ecological impact and social repercussion, insofar as it contributes to the welfare of their employees and the community in which they operate [94].

The ISO 26000 Social Responsibility standard, published by the International Organization for Standardization (ISO), explains that this social responsibility is

“Organizations around the world, and their stakeholders, are becoming increasingly aware of the need for and benefits of socially responsible behaviour. The objective of social responsibility is to contribute to sustainable development. An organization’s performance in relation to the society in which it operates and to its impact on the environment has become a critical part of measuring its overall performance and its ability to continue operating effectively. This is, in part, a reflection of the growing recognition of the need to ensure healthy ecosystems, social equity and good organizational governance. In the long run, all organizations’ activities depend on the health of the world’s ecosystems. Organizations are subject to greater scrutiny by their various stakeholders”. [95]

However, in many cases there is still work to doing so balance social and environmental factors more equally.

For its part, sustainable development refers to development that meets the needs of the present without compromising the capacity of future generations. The way in which companies and organisations contribute to this sustainable development is called corporate sustainability and has been defined as “a business approach that creates long-term shareholder value by embracing opportunities and managing risks deriving from economic, environmental and social developments” [96].

As Sahely et al. [97] (pp. 74–75) points out, “as a generic framework put forward to help define the infrastructure system and understand its interaction with environmental, economic, and social systems”. This corporate sustainability or the interest of organisations in their social and environmental impacts does not derive, however, in a proactive strategy with nature, but rather in an adequate management of scarce resources. Thus, for example, although according to the KPMG 2017 report on corporate responsibility reporting, 72% of the 100 largest companies in 49 countries analysed published CSR reports, most of these companies do not recognize climate change as a financial risk in their annual reports (72%) and of the minority that does consider climate risk, very few attempt to quantify or model the value at stake for the business. In addition, although 50% of these companies disclose their objectives of reducing greenhouse gas emissions, these reduction targets are not linked to global climate objectives, such as the Paris Agreement or the EU objectives [98]. In this regard, Dsouli et al. [99] propose a global self-sustainability index for countries in four metrics—economic, environmental, social, and innovation.

Unlike Organisational Biomimetic, Corporate Social Responsibility and Sustainability strategies do not consider the demands and needs of the planet, or take it into account only as long as they intend not to harm it, but in any case, the planet is something alien that they forget about or try—in the best of cases—to harm as little as possible, putting the focus on the success (economic, reputation) of the organisation. In essence, they are still anthropocentric approaches.

The substantial difference, therefore, is that Organisational Biomimetic understands the organisation as part of nature—that is, a vital, holistic and systemic view that simultaneously addresses the interests of the rest of the subsystems that make up the larger system that we call the planet. Therefore, organisations acquire a worldview.

In particular, we can focus the differences in organisational paradigms in two aspects: (1) Unlike CSR and Sustainability, the biomimetic approach provides the organisation with the experience of belonging to the Earth ecosystem, which positions it in an optimal place to learn and operate with

respect for all life forms. (2) CSR and Sustainability emphasize development, while Biomimicry is not conceived as an objective [100].

5.2. The Circular Economy

For the Ellen MacArthur Foundation [32], the circular economy is “a new way to design, make, and use things within planetary boundaries. Shifting the system involves everyone and everything: businesses, governments, and individuals; our cities, our products, and our jobs. By designing out waste and pollution, keeping products and materials in use, and regenerating natural systems we can reinvent everything”.

The circular economy is based on three key principles, each of which addresses several of the challenges in terms of resources and the system that industrial economies have to face—(1) preserve and improve natural capital: controlling finite stocks and balancing the flows of renewable resources; (2) optimise the use of resources: rotating products, components and materials with maximum utility at all times, both in technical and biological cycles; and (3) foster the effectiveness of the system: revealing and eliminating negative externalities.

Scott [101] relates sustainability to the Circular Economy and points out that when a product is designed to have a long-life cycle, this contributes to sustainability. For this reason, some authors consider that the Circular Economy is a paradigm of action that has evolved from the concept of sustainability, advancing different strategies throughout the chain of production and use of products and services [46].

From this perspective, the Circular Economy presents the same anthropocentric view of the productive process that we attribute to Sustainability: nature is a resource that must be protected and taken care of insofar as it is useful for the productive process. However, the analysis of the Circular Economy model does not reveal any reference to the social area that is explicitly included in the Triple Bottom Line of CSR and sustainability. Since “the circular economy is the intersection of the environmental and economic aspects” [102], the social environment seems to be left outside the scope of action of the processes linked to the Circular Economy. However, the concepts of commitment, intercultural solidarity and responsibility must be linked to our definition of sustainable behaviour [92].

Taking into account the characterisation that we have described, in addition to the differences that have already been pointed out when talking about the paradigm of Sustainability (anthropocentrism vs. worldview and differences in the development objective), we can point out two differences between Circular Economy and Biomimicry—(1) in the biomimetic model, the social component is inextricably linked to business management but, although positive social externalities appear in circular economy processes, these are not explicit in the objectives or strategies of the movement; (2) Biomimicry goes beyond the processes of product development and care of the environment by reducing waste, since it is the optimal use of resources learnt from nature.

5.3. The Collaborative Economy

The European Commission [103] (p. 3) says that collaborative economy refers to “business models where activities are facilitated by collaborative platforms that create an open marketplace for the temporary usage of goods or services often provided by private individuals”. Gómez-Álvarez and Morales-Sánchez [104] argue that the true collaborative economy is based on a community of equals that collaborates, cooperates and shares in a network through fair systems that seeks the welfare of the community in which they are inserted. In a first phase, the “common” collaborative economy was talked about [105] as a way to collaborate in a disinterested way; later new models of business activity have emerged, such as platforms in social networks. In general, these are businesses that have a large capital, so some authors call it “platform capitalism” [106]. Although in principle it is an approach that puts the focus on mutual interest, multiple cases of perversion of the system by large companies are causing the collaborative economy to be questioned. In 2016, the first fine in Spain was imposed on the company BlaBlaCar for exercising its activity with motive for profit and under unfair competition, the

Uber company has been evicted from several territories in which it was carrying out its activity, and governments are trying to legislate to restrict activities of this type.

In any case, the Collaborative Economy focuses on the exchange relationships between two or more systems, with the exchange itself being the axis of the relationship and therefore ignoring what can be learned from nature and how we can learn it, in order to establish more respectful relationships with people and with the planet.

Figure 1 shows a summary of the comparison between the new economic and management approaches.

Comparison between organisational management approaches					
	CSR	SUSTAINABILITY	CIRCULAR ECONOMY	COLLABORATIVE ECONOMY	ORGANIZATIONAL BIOMIMICRY
LEIT MOTIV	Impact on stakeholders	Make compatible benefits with ecosystems and apply welfare indexes	Maintain the usefulness of the products, components and materials, and preserve their value	Get economic benefits	Learning from nature
GOALS	Contribute to the competitiveness and sustainability of the organisation	Respectful development, welfare. Satisfying current needs without ruining the resources of the new generations	Development optimization (and economic improvement)	Increase profits by lowering fixed costs, although in theory it seeks to consider services as exchange goods	Business in harmony with nature, as a subsystem of the Earth ecosystem
MEANS	International standards, certifications, organisation reports	Sustainability measures, political plans, triple result measures, performance index, GRI, DJSI, SGMA, etc.	Repair, recycle, neutralize, remanufacture	Crowdfunding Crowlending P2P (*) B2C (**) B2B (***)	Science and technology as a testing bench of what has been learned observing nature
PEOPLE	Integration of CSR in Human Resources strategies and policies	Training and awareness	Specialization in process management and materials study	Unfair competition, lack of protection, precarious work	Creative, committed, ethical (health and wellness)

(*) P2P: Peer to peer. Organisations provide the infrastructure to share or rent
 (**) B2C: Business to consumer. Organisations use technological advances for customers to access their products
 (***) B2B: Business to Business. Organisations provide tools or services to other organisations

Figure 1. Comparison between organisational management approaches.

As already stated in the characterisation of biomimetic organisations, Organisational Biomimicry proposes (1) a systemic approach; (2) a worldview that places the organisation and the people related to it as an integral part of nature; and (3) an R&D system based on continuous learning from nature.

In Figure 2, we present in a schematic way the concepts explained up to now, with special emphasis on the anthropocentric view of traditional trends and the worldview of Organisational Biomimetic.

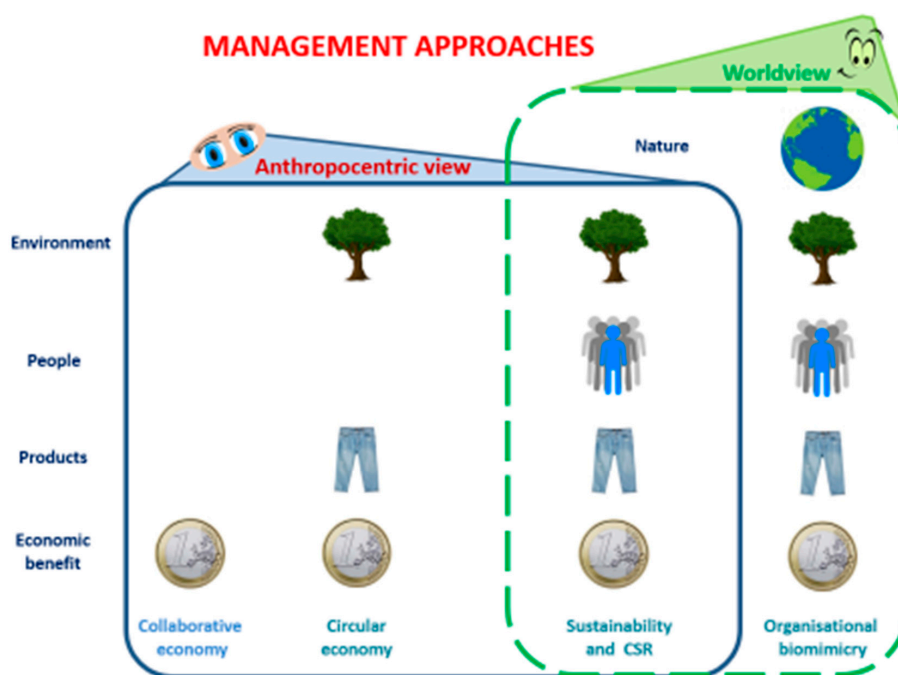


Figure 2. Comparison between organisational management approaches.

6. Conclusions

Given the growing evidence of the damage caused to our environment and the urgent need for an economic, social, and environmental model capable of reversing the situation in a short time and generating a stable environment of coexistence, this work proposes adopting Biomimicry as a business management model, presenting the main characteristics of biomimetic organisations and showing the fundamental differences with the new business paradigms (Sustainability, the Circular Economy, and the Collaborative Economy). Therefore, our study has implications for researchers, practitioners, and public administrations because the proposed model may guide them on future steps to be taken.

This paper offers academics the opportunity to develop a debate around the relationship of organizations with their surrounding environment and the viability of a business model that uses nature as a model, measure and mentor. “Nature as a measure” means, among other things, being able to re-evaluate organizational results not only in economic terms, nor in terms of sustainability, but in relation to the damage or benefit that the impact of the organizations has on nature itself. It is a matter of rethinking the value of nature, that is, considering it as a stakeholder that has its own relevance, beyond the use that companies can make of the resources it offers for the productive process. In this context, the proposed model can serve to reflect on the purpose of organizations and question the validity of the assumptions that proclaim economic growth as a necessary and sufficient condition for business success. “Nature as a model and mentor” proposes that experts in organizational theory look to nature for efficient and sustainable systems to try to export them to human organizations. This takes the form of a call for interdisciplinarity that is giving remarkable results in fields such as biology and robotics or medicine. It also implies overcoming the mechanistic conceptions of organizations in order to move towards an organic vision of them. Finally, in the comparison with the anthropocentric model that supports the approaches of the Circular Economy, CSR and the collaborative economy, the worldview of the proposed model redirects the research to the theory of open systems, deepening the relationships between systems (companies-clients-suppliers-competitors-near society-state- and the planet as a whole) and favouring the determination of common objectives (such as the Sustainable Development Goals).

For professionals, the biomimetic model can suggest improvement systems that have been shown to be effective in natural environments such as; efficient energy use, use waste as a resource, optimize rather than maximize, use materials sparingly, shop locally and so on. The biomimetic management model contributes to the organisation in the following ways: (1) stimulation of creativity, pride of belonging, commitment and well-being of people who directly or indirectly relate to it; (2) optimal use of all resources; (3) understanding and imitation of the vital mechanisms of the Earth that need to be respected and protected; (4) continuous improvement in the definition and implementation of strategies and policies; (5) innovative and disruptive products or services; (6) active involvement of customers and suppliers; (7) triple bottom results sustained over time; (8) complicity with society; (9) conservation of the planet for future generations (human and non-human); and (10) welfare in the organisation subsystem and in the other subsystems with which it directly or indirectly relates. Furthermore, beyond good practices learned from nature, the mature system models of Benyus [11] can improve current management systems by encouraging business managers to look at nature, imitate it, and be inspired by it to find creative ways to solve problems. In order to meet these challenges, organizations need ethical leaders that recognize part of the natural system with which they relate—and learn from—in order to obtain mutual benefit.

Finally, in relation to policy stakeholder, our research highlights the need to take global measures to enable societies to redirect the production model to promote true sustainable development. This will only be possible if organizations are able to understand the worldview approach advocated by Biomimicry.

Thus, our work aims to add to the scientific knowledge of organisations a new model based on the contributions of Biomimicry and generate a debate concerning business approaches consistent with a well understood sustainability—not only for human beings but for the supra-system of nature

in general. Because “the philosophy of sustainability tends to nuance the very notion of development, taking into account, on the one hand, the compatibility of economic development with ecosystems and, on the other, taking into consideration welfare indices that are not limited to what the gross domestic product will be in a given moment. It is understood then that the development to which we must aspire is not any development, but a development in dynamic equilibrium, self-centred, rationally planned, and, as far as possible, based on biomimicry, that is, on the imitation of the natural economy of ecosystems” [100] (p. 4).

In the last 45 years, humanity has modified the Earth’s climate 170 times faster than the average of the preceding 7000 years [107]. Humanity still has the possibility of preventing catastrophic climate change, but that time is running out fast [108]. The global economy can work equally well with zero emissions, and research shows that we can feed 9 billion people—the world population projected for 2050—and reduce greenhouse gas emissions at the same time.

It is possible, therefore, to move forward with the biomimetic approach, to which organisations can contribute in a relevant way: the biomimetic approach focuses on the functioning of terrestrial organisms and ecosystems that, like human beings, need to cover their needs and, at the same time, conserve resources and not damage their vital environments. Organisations work to meet vital needs and can do so relying on the biomimetic model to contribute positively to the conservation of the planet.

In the words of Pauli,

“Our production and consumption schemes have become obsolete and are incapable of responding to everyone’s basic needs. They have to evolve or be replaced by others that thrive in harmony with the totality of life, promoting diversity and ensuring food, shelter, health and sustenance for all. With this conclusion in mind, we direct our admiration and attention to the adaptive mastery of nature”. [10] (p. 98)

Ecosystems, both “natural” and “artificial” can and should interrelate for our mutual benefit and that of all Nature because, now more than ever, we need to remember the Indian saying, “The Earth is not an inheritance from our parents, but a loan from our children”.

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