

ANALYZING THE HUMAN SPHERE WITH THE CIRCULAR ECONOMY MODEL IN POST- EARTHQUAKE CONSTRUCTION: MECHE'S HOUSE

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Meche's House is a post-earthquake house construction in Pedro Carbo, Ecuador. This article is based on the analysis of this construction under a specific model called Circular Economy (CE). The CE analyzes the flows of matter and energy, ensuring that everything recirculates in the system, causing the so-called waste to become a nutrient for new processes. This article explains the traditional concept of CE, based on the butterfly model by Ellen MacArthur Foundation which inserts flows of matter and energy in two spheres: biosphere and technosphere. However, this article inserts and analyzes a new one: the human sphere. The system for the construction of Meche's House is analyzed especially under the latter sphere, to understand the local people as a resource within the system flows, emphasizing the post-earthquake context.

Keywords: Biosphere, Technosphere, Waste, Nutrients.

1 INTRODUCTION

The flows of matter and energy in the Circular Economy (CE) can be seen within three spheres: biosphere, technosphere and human sphere. The system behind the construction of Meche's house is a concrete example of the interconnected energy and matter flows that can be translated as circular. The flows embedded in this system can be seen in the construction materials, in the design of the house and in the use of skills and labor of the community of Pedro Carbo in Ecuador. It is important to emphasize the different actors involved, as they are also part of the flow of matter and energy under the analysis of CE. Various actors such as Meche (a woman called like that by the community who is the owner of the house that was built after the earthquake) and her family, residents of Pedro Carbo, PACARI (a company that works with cocoa farmers in the area) and Ensusitio (an organization that works on construction techniques) participated in the post-earthquake construction of the Meche house. This article will begin with a brief introduction of the concept of CE and then analyze it within the context of Meche's House.

1.1 The Circular Economy (CE)

The current linear economic system of extracting resources, generating products and disposing of them, is reaching its limit. This linear system is creating a large amount of waste that is not only

depleting resources and polluting our planet, but also, leaving aside social, environmental and economic opportunities. The concept of CE is formulated to "rethink" the current economic system and to drive a system that is restorative or regenerative from its intention and design. It aims at the elimination of waste as a concept through a superior design of materials, products and business models, so that everything returns and is used in new processes. It replaces the end-of-life concept of products with restoration; it drives changes to the use of renewable energy and eliminates the use of toxic chemicals and construction materials that prevent the reuse and return of materials to the biosphere (Ellen MacArthur Foundation 2014).

The CE is largely rooted in similar fields of study, such as Cradle to Cradle, Biomimetic and Industrial Ecology. Therefore, it is not a new concept; however, it has had a successful diffusion in recent years. The Ellen MacArthur Foundation (EMF) has propagated the concept of CE in a butterfly diagram (See Figure 1) that explains a continuous flow of technological and biological materials through a value chain approach, closing the processes by cascades (Ellen MacArthur Foundation 2013).

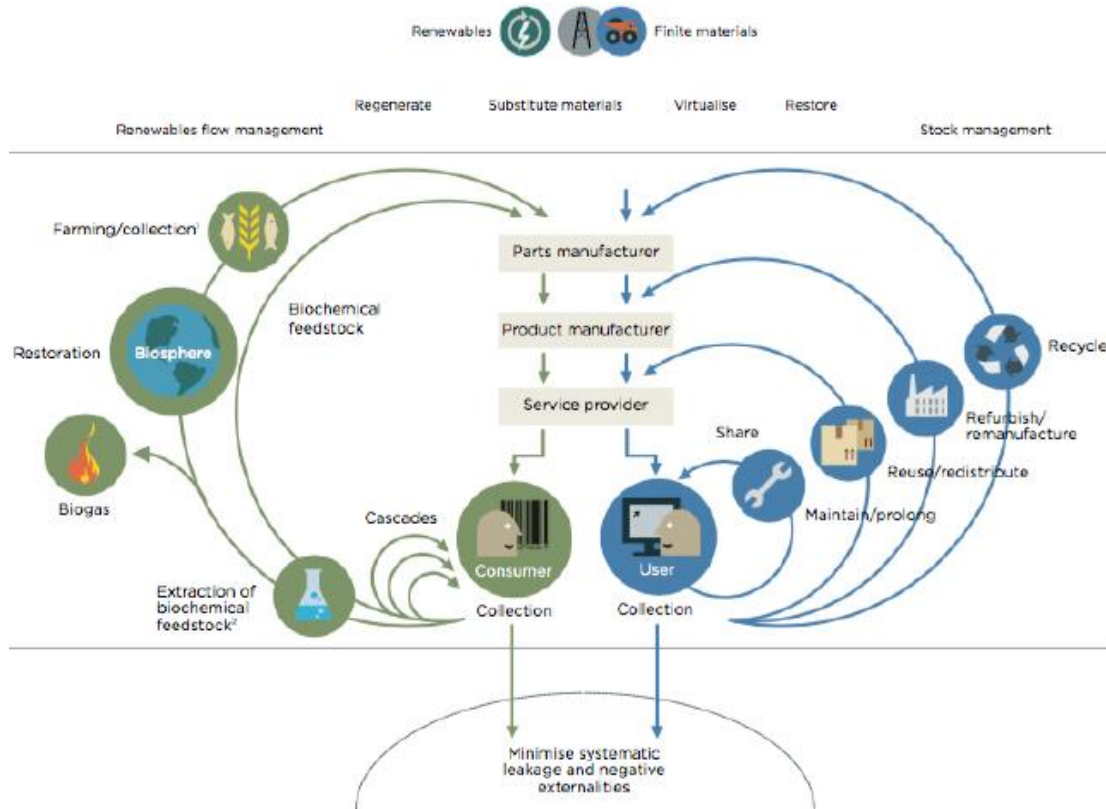


Figure 1. The Circular Economy Butterfly Diagram (Ellen MacArthur Foundation 2013).

The diagram (Figure 1) demonstrates a correlation between two subsystems: the biosphere and technosphere. On one hand (left side of the diagram), there are flows of biological nutrients from the biosphere, resources that are produced directly by nature and which processes can be used for human use. At this sphere, natural processes related to ingestion, digestion, excretion and reproduction occur (Van der Voet 2002). On the other hand, (right side of the diagram) there are technical flows of the technosphere, which contain the stocks and flows, products and

services, controlled and caused by humans (Van der Voet 2002), which in a model of CE must be reused in cascades, and recirculate, without contaminating. The technosphere in that sense should function and should be designed in order to replace the concept of waste to the one of nutrients that feed new processes, such as in the biosphere system.

1.2 The Humansphere

It is important to reconsider the model of CE within the butterfly diagram, introducing the concept of humansphere that could help rethink the role of humans in a CE system (Lemille, 2017a). See Figure 2.

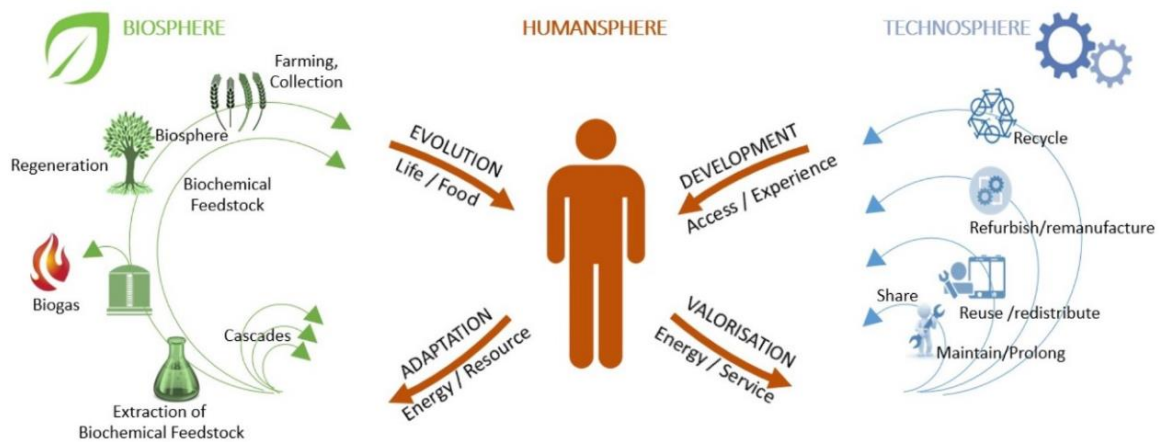


Figure 2. The humansphere in the Circular Economy (Lemille 2017a, adapted from the “Butterfly Diagram” of the Ellen MacArthur Foundation).

Adding and analyzing a humansphere, provides an opportunity to develop an inclusive CE, especially in emerging economies. This means making the social impact the generating force rather than developing other areas first, such as the one in the technosphere. Based on Lemille, 2017a, the four arrows shown in the human sphere are:

Adaptation: refers to rethinking about the function of the human being as energy and as a resource towards the biosphere. According to Cradle to Cradle all ants weigh more than all humans (McDonough and Braungart 2010), however, through their functions, they renew the biosphere. It is imperative to talk about the function of humans in the biosphere. Human beings can change their role with adaptive strategies and rebuild the ecosystem.

Evolution: the arrow that comes from the biosphere focuses on the human being behavior towards all the environmental services. Evolution refers to rethinking about the role of human beings and their interconnection with planet Earth.

The two arrows, both adaptation and evolution, should be developed for the benefit of the two spheres (biosphere and human sphere), moving away from the current destructive relationship that exists with extraction, production and disposal.

Valorization: this arrow emphasizes the value that humans represent as skilled labor in the service of the technosphere. It refers to the preservation of all the knowledge, education and skills. Questioning about the abundance of human energy in an innovative way could provide positive results with the current growing world population.

Development: this arrow refers to development as a result of the exchanges of the three spheres. Decisions are made based on the well-being of the human being as an integral part of an

upcoming economic framework. With this approach, human beings can enjoy co-designed and value-based services.

The development of the human sphere within the CE is essential to combat poverty. It is imperative to realize that the concept of is a human construction that needs to be re-designed. It is also a way of bringing the CE concept close to emerging economies, where social inequality and environmental problems abound (Lemille 2017b).

For example: governments can establish laws that support and allow social inclusion; companies can get involved and empowered informal workers; industry leaders can ensure that smaller actors are accounted for in all sectors; consumers can point out a demand for fairer products; and employers can adopt commercial models of labor integration (Lemille 2017b).

2 ANALYSIS OF MECHE’S HOUSE CONSTRUCTION UNDER CE CONCEPT

The system behind the construction of Meche's house has several features that allow it to be analyzed under the CE concept with its material and energy flows in all three spheres. See Figure 3. The use of existing materials from nature in the area for construction is represented in the biosphere. In the human sphere, it is analyzed under the design of the house with the community, skills and labor of the inhabitants of the place, preservation of knowledge and education. Finally, in the technosphere the house is found as the final product and its useful life within the system.

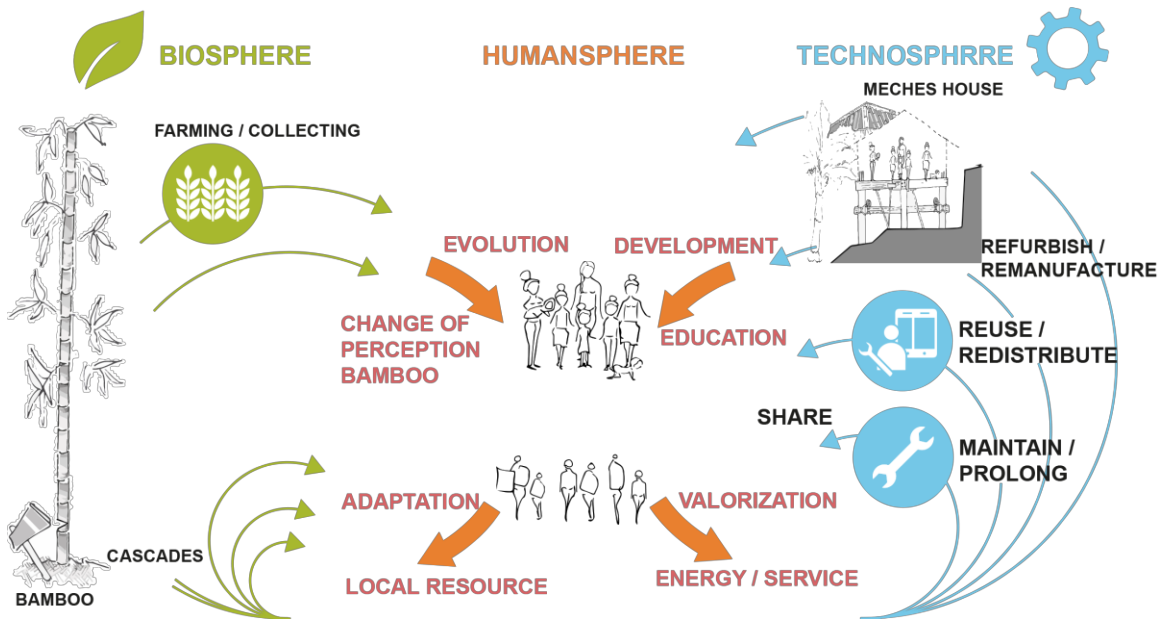


Figure 3. Adaptation of the butterfly diagram with the humansphere (Lemille 2017a adapted from the “Butterfly Diagram” of the Ellen MacArthur Foundation 2013) in the context of the construction of Meche’s House.

Biosphere: For the construction of Meche’s house, an analysis of the local resources was carried out, which were used as raw material. The soil of the area was clayey, which allowed using less cement and reducing its construction costs. In addition, other resources were used, for example, the walls were made of bareque (a mixture of clay, sand and coconut fiber). The walls were also constructed of chopped cane, using guadua cane (Ensusitio 2017).

Humansphere: The four parts of this sphere are analyzed within the context of Meche's house: adaptation, evolution, development and valorization. It is important to clarify that many of the processes that occurred in the post-earthquake context in Pedro Carbo are difficult to quantify economically. However, this does not mean that they do not have a value. In fact, the CE model makes these processes visible and place them as a valuable resource with the potential to continue recirculating in the system.

With regard to adaptation, there is an interconnection between the biosphere and the humansphere, not only through the use of natural resources, but also, through the participation and use of the workforce of the neighbors of Pedro Carbo. The initiative called Architecture on its site established a workshop on good construction practices and designed the house together with the vision and contributions of Meche, the owner of the house. It was designed to the needs of her and her family and adapted to the environment of the area. Additionally, the workshop served as a link with the community, not only to teach good constructive practices but to create a social fabric that can serve to replicate this type of initiatives in the place.

With respect to evolution, a change in behavior can be seen in relation to environmental services. Meche's house was built based on Guadua cane. This material was perceived in the area as low quality and cement was mostly preferred. At the beginning of the construction, many called the house "the house of the hoyeritas", a bird that builds its nest like an earth oven, straws and saliva (Ensusitio 2017). However, through the workshop, design and construction with the population, it was demonstrated that this is one of the materials that best suits the climate. It is a resistant earthquake material and it is abundant in the area. As the construction of the house with its benefits was realized and seen, people in Pedro Carbo began to change their perception regarding the material. In this way, they rediscovered the use and the process required by the Guadua cane for construction: submerge it in saltwater for its healing and use (Ensusitio 2017).

In the valorization part, the flow of energy can be clearly seen with respect to the labor used. In fact, the leadership for the construction of the house was in charge of two local people, who through the workshop received the necessary training to carry it out. PACARI (a famous chocolate company in Ecuador) together with Ensusitio, were able to design a payment system for these two people. However, beyond the economic retribution, an important social fabric was formed, since the residents of the house of Meche participated, many of them without any economic retribution. The valorization about the role of the human being with the technosphere, since the workshop provided not only preserved knowledge and needs, but also moved to educate and reaffirm skills in the population that can then be reused for the construction of new houses in Pedro Carbo

Finally, with development, it is possible to see that the construction of Meche's house was co-designed with its user and the environment. This union can be seen in the connection of the three spheres, use of natural resources and their adequate adaptation to the environment, the construction of the house based on local skills and its possible reproduction in the area. It suggests a possible circular business model, in which monetary remuneration is not necessarily required, but on the contrary, allows us to see an exchange of knowledge flows that can be reproduced and be beneficial in the place.

Technosphere: once the house was built as a final product, it was guaranteed that it had a long-life use. Additionally, it is possible to repair it with local resources. Unlike the block, its raw material, such as guadua cane can return to the biosphere and be part of other natural decomposition processes. This return to the biosphere also creates opportunities for the people of Pedro Carbo to use their skills and workforce in search of new circular economy businesses.

3 CONCLUSIONS AND RECOMENDATIONS

Analyzing the construction system behind Meche's House as a model of CE allows visualizing other types of flows of matter and energy that are often not economically quantifiable. Beyond this, it allows to understand in a concrete way, the flows that interrelate in the three spheres: biosphere, humansphere and technosphere. In the biosphere, there is the use of natural resources such as guadua cane and its way of adapting it to the environment. In the humansphere, this adaptability is highlighted, taking into account the design of the house, labor, education and the development of skills behind the workshop. With respect to the technosphere, it is possible to see the finished product and its useful life, repairing it and adapting it to the environment. This analysis, above all, highlights the value of the human being and gives it new opportunities to reconnect with nature and its resources.

The humansphere is a new vision within the CE promoted by Alexandre Lemille in South Africa; it requires even more analysis and study. However, it is important to consider this characteristic within the model because, in addition to presenting opportunities, it brings the emerging CE model closer to emerging economies that must deal with other factors such as labor informality and the use of natural resources in a responsible way to the environment. In this model, people have another type of access regarding their skills, education and reconnection with the resources of their own environment.

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