DATABASE OF CIRCULAR ECONOMY ARTICULATED TO SUSTAINABLE DEVELOPMENT IN MEXICO

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Abstract

Population growth has been one of the most frequently mentioned causes to explain the overexploitation of natural resources and has been determinant of the current global condition, which is characterized by the increase in the volume of resources exploited, the total consumption of resources and the generation of waste and emissions (SDG, 2015). In this context, research is proposed, with the aim of reviewing and identifying the theoretical bases of the Circular Economy and sustainable development (GRI Standards) to design a qualitative measurement database that allows diagnosing and articulating initiatives, practices, actions and strategies that are being developed and implemented in companies, aimed at achieving the transition to the paradigm of the circular economy, since this represents an opportunity to organize production and consumption in the global economy, as it promotes the four Rs: Reduce, Reuse, Recycle and Recover. The design of the research is in the first stage, of documentary type with descriptive and exploratory scope. It should be noted that various national and international databases were consulted for the search and analysis of information. In the second stage, the design of the database is proposed through a technical methodology, to be used as a tool for sustainability-oriented companies. The preliminary conclusions of this study show how the circular economy is articulated with the dimensions of sustainable development: the economic, social and environmental dimensions of the (UN (2015). It is intended that companies implement the database, as a sustainability tool aligned with the circular economy and Sustainable Development (UN, 2015) and represents an opportunity to give the planet a break.

Key words:
Circular economy, GRI, Environment, Data base, Articulation

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Introduction

The environmental crisis has been the subject of discussion and debates identified in the 2030 Agenda and suggested from the Sustainable Development Goals to overcome it. The proposals for actions of International Organizations such as the United Nations (UN), the United Nations Environment Programme (UNEP), the Organization for Economic Cooperation and Development (OECD), the Economic Commission for Latin America and the Caribbean (ECLAC) and the European Union (EU) have managed to enter the political agendas of most countries through their governments. academia, civil society organizations and private initiative incorporating them in this process towards the paradigm shift of circular economy and begin to promote innovations with environmental and sustainability criteria in products, processes, services (Porcelli and Martínez, 2018).

Literature review

1. Background to sustainability

Before starting with the topic of sustainability, it is necessary to refer to the background that promotes sustainable development, clarify and identify the reasons for this need. Sustainable development is defined in the report Our Common Future, published by the World Commission on Environment and Development in 1987 as "that which meets current needs without compromising the ability of future generations to meet their own needs" (cit. in Gómez, 2012, p.61). However, this definition of almost 30 years ago has become obsolete, because that long-awaited future has become our

present, where the effects of climate change are already experienced and the amount of resources that new generations will have are uncertain; According to Hernández (2009), economic development has been responsible for this situation, privileging an industrial model that pursues high growth rates causing the deterioration of nature, which has its origins for more than 200 years with the Industrial Revolution. The production, distribution and consumption of this model are the cause of environmental pollution, deforestation and loss of biodiversity. In Rio de Janeiro, Brazil, the Heads of State renewed their commitment to the eradication of poverty, the modification of unsustainable patterns and the promotion of sustainable consumption and production patterns, the protection and management of the natural resource base of economic and social development as indispensable requirements of sustainable development (UN, 1992, 2012). It should be added that the importance of the active participation of the public, private, private initiative, scientific and technological community in sustainable development is highlighted.

The United Nations (UN) in September 2015, was approved at a historic summit held in New York City, the 2030 Agenda for Sustainable Development, which stands out as a transcendental agenda because it states that "it will serve as an action plan for the international community and national governments to promote prosperity and common welfare in the next 15 years". This agenda proposes 17 objectives with 169 goals of an integrated and indivisible nature that contemplate the economic, social and environmental dimensions.

The Global Reporting Initiative (GRI) guide was designed for companies to prepare their sustainability reports and includes three dimensions: economic, social and environmental, as shown in Table 1. The GRI's long-term objective is to integrate these three categories, understanding that sustainable development can only be achieved through their proper integration.

Table 1. Elements of the sustainability report of companies (GRI)

Economic	Environmental	Social
• Market presence • Economic impacts	• Impact of processes, products and services on the environment. • Efficient use of natural resources in production: raw materials, water and energy • emission level	• Health and safety in the workplace. • Employee stability. • Estabilidad de los empleados • Labor rights, human • Relationship and transparency in the community

Source: Own elaboration based on the GRI Guide

2. Environmental dimension of sustainability reports

The environmental dimension of sustainability refers to an organization's impacts on living and inert natural systems, including ecosystems, soil, air, and water. Environmental indicators cover performance in relation to input (materials, energy, water) and output (emissions discharges, waste) flows. They also include performance in relation to biodiversity, environmental legal compliance and other relevant data such as expenditures of an environmental nature or the impacts of products and services; adding the following environmental aspects: materials, energy, water, biodiversity, emissions, discharges, waste, products and services, regulatory compliance, transport finally general aspects (UN, 2011), condensed in Table 2.

Table 2. Environmental dimension of the GRI

Categories and coverage of the circular economy and sustainable development (indicators)	**Environmental dimension**	**Circular economy 4 R's Recycle Remanufacturing** Reuse	**Main initiatives, activities, strategies used in the private initiative and HEIs related to the GRI and LA EC**
		R R R R	
Materials used by weight and volume.	Materials	Sustainable use of resources	Efficient Resources Usage
Percentage of materials used that are recovered materials.	Materials		Remanufacturing Support
Direct energy consumption by primary source.	Energy	Sustainable use of resources	Energy consumption Organization Use of renewable energy
Indirect energy consumption by primary source.	Energy	X	Energy consumption Organization
Energy savings due to conservation and efficiency improvements.	Energy	X	Energy consumption Organization Use of renewable energy
Initiatives to provide renewable energy efficient products and services and reductions in energy consumption as a result of such initiatives.	Energy	X	Energy consumption Organization Use of renewable energy
Initiatives to reduce indirect energy consumption and reductions achieved in such initiatives.	Energy	X	Energy consumption Organization
Total water abstraction by source.	Water	Sustainable use of resources	The organization have a water collector
Water sources that have been significantly affected.	Water	X	The Organization have a recycling and water treatment plant
Percentage and volume of recycled and reused water.	Water	X	The organizations have recycled and reuse water
Description of land adjacent to or located within protected natural areas or areas of high biodiversity not protected.	Biodiversity	Protection of the environment and biodiversity and restoration of natural habitats	Reforestation Biodiversity protection zone
Description of the most significant impacts on biodiversity in protected natural areas or in areas of high biodiversity not protected.	Biodiversity	X	Strategies to reduce impacts on biodiversity
Protected or restored habitats.	Biodiversity	X	Strategies to protect and restore habitats
Strategies and actions implemented and planned for the management of impacts on diversity.	Biodiversity	X	Strategies implemented for the management of impacts on diversity
Number of species, disaggregated according to their danger of extinction and whose habitats are in areas affected by operations according to the degree of threat of the species.	Biodiversity	X	Does not apply
Total and indirect greenhouse gas emissions by weight.	Emissions, discharges and waste	Climate change mitigation and adaptation	Reduce Environmental Emissions and waste reduction
Other indirect greenhouse gas emissions, by weight.	Emissions, discharges and	X	Reduce Environmental Emission

	waste		s and waste reduction
Initiatives to reduce greenhouse gas emissions and reductions achieved.	Emissions, discharges and waste	X	Reduce Environmental Emissions and waste reduction
Emissions of ozone-depleting substances, by weight.	Emissions, discharges and waste	Prevention and pollution	Reduce Environmental Emissions and waste reduction
NO AND SO and other significant air emissions by type and weight.	Emissions, discharges and waste	X	Reduce Environmental Emissions and waste reduction
Total discharge of wastewater, according to its nature and destination.	Emissions, discharges and waste	X	Reduce Environmental Emissions and waste reduction
Total weight of waste managed, by type and methods of treatment.	Emissions, discharges and waste	X	Reduce Environmental Emissions and waste reduction
Total number and volume of the most significant accidental spills.	Emissions, discharges and waste	X	Reduce Environmental Emissions and waste reduction
Weight of transported, imported, exported or treated waste considered hazardous.	Emissions, discharges and waste	X	Reduce Environmental Emissions and waste reduction
Identification, size, protection status and biodiversity value of water resources and related habitats, significantly affected by water and water discharges.	Emissions, discharges and waste	Sustainable use of resources Protection of the environment, biodiversity and restoration of natural habitats	Reduce Environmental Emissions and waste reduction
Initiatives to mitigate the environmental impacts of products and services degree of reduction of that impact.	Products & Services	Sustainable use of resources in the value chain Sustainable consumption	Process Optimization Product Lifecycle Extension Assets Lifecycle Extension
Percentage of products sold and their packaging materials, which are recovered at the end of their useful life, by product categories.	Products & Services	Pollution prevention Sustainable use of resources Sustainable consumption	Process Optimization Product Lifecycle Extension Assets Lifecycle Extension
Cost of significant fines and number of non-monetary penalties for non-compliance with environmental regulations.	Compliance		Productive Cost Environmental costs due to legal non compliance
Significant environmental impacts of transportation and other goods and materials used for the organization's activities, as well as transportation of personnel.	Transport	Sustainable uses of resources in the value chain	Supply Chain Interconnection
Breakdown by type of total environmental expenditure and investment.	General		Improved Production Flexibility Efficient Resources Usage Assets Lifecycle Extension

Source: Own elaboration based on the GRI Guide

3. Circular economy

The intervention of human beings on the planet has reached the limit, endangering human existence itself. Global warming is the one of greatest concern worldwide; population growth and consumption patterns are leading to an increase in demand for natural resources, the International Energy Agency warns that energy consumption will rise by 30% globally by 2040; However, we are experiencing an energy crisis reflected in record prices, fuel shortages, increased poverty, slowing economies (IEA, 2023), which became a global energy crisis after the Russian invasion of Ukraine in February 2022 due to the increase in the price of natural gas and because of it electricity in some markets. Therefore, it is necessary to take advantage of natural resources responsibly and avoid irreversible damage. In turn, the 2030 Agenda (SDG) and in the actions of the European Commission (EC) to support the circular economy, sustainability is linked to the problems related to modern societies and the planet.

The circular economy aims to change the linear model of use and throw away for one that resembles the circular system, which presents the biological cycle in nature in a way that optimizes the use of resources and reduces waste (Porcelli and Martínez, 2018; Arroyo, 2018; WBCSD, 2022). Its goal is to retain as much of the resources, products, parts and materials as possible to create a system that allows for long life, reuse, conditioning, remanufacturing and recycling.

On the other hand, the paradigm of the circular economy, emphasizes the production and management of waste, as the core of any economic activity within the framework of the global economy through the (SDGs), implies: the reduction of the consumption of raw materials, the transformation of waste into secondary raw materials, the promotion of high rates of reuse and recycling, the reduction of energy and water consumption and the reduction of pollution that can be caused by waste. It is necessary to refer to (Pagés, 2021; Belda, 2018) who say that the circular economy addresses the growing challenges related to the overexploitation and overconsumption of natural resources faced by companies and economies (e.g. overfishing, deforestation, water scarcity, the case of fossil fuels).

Principles of the circular economy.

The circular economy as pointed out by the MacArthur Foundation is restorative and regenerative by design and aims to always keep products, components and materials at their highest levels of use at all times, distinguishing between technical and biological cycles.

According to the Ellen MacArthur Foundation, the circular economy is based on three principles:

1. Preserve and enhance natural capital, controlling finite stocks and balancing renewable resource flows. "When resources are needed, the circular system selects them sensibly and chooses technologies and processes that use renewable or higher-yielding resources."
2. Optimize the performance of resources, through circulation of products, components and materials in use, to their maximum utility at all times in both technical and biological cycles. "This involves designing to remanufacture, refurbishing and recycling to keep technical components and materials circulating and contributing to the economy (internal loops), this is to increase the useful life of products and optimize reuse." It should be added that circular systems also promote biological principles to re-enter the biosphere safely so that decomposition results in more valuable materials for a new cycle. In the life cycle, products are deliberately designed to be consumed or metabolized by the economy and regenerate new resource value. In the case of biological materials, the essence of value creation is the opportunity to extract additional value from products and materials by cascading them through other applications. See table 3.

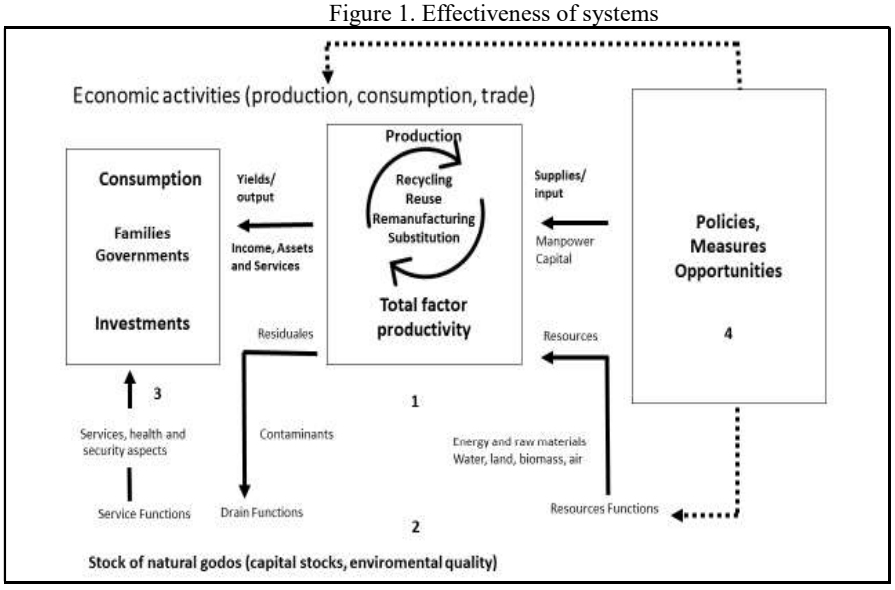
Table 3. Principle 1 of the circular economy

Life cycles	Industry and manufacturing materials	Technical cycles
Agriculture and harvesting	Materials and manufacture of parts	Recycle
Biochemical raw material	Manufacture of the product	Reconditioning and remanufacturing
Soil restoration	Retailers and Service Providers	Reuse and redistribute
Biogas	Consumer/user	Maintain/Share
Anaerobic digestion and composting		
Biochemical raw material extraction		
Gathering		
Energy recovery		
Dump		

Source: Own elaboration based on (MacArthur Foundation, 2010; EU, 2012, 2016)

3. Promote the effectiveness of systems by detecting and eliminating negative external factors from the design. This principle includes reducing damage to systems and areas such as food, mobility, reception center, education, health and leisure and managing external factors such as land use and noise, air and water pollution or the discharge of toxic substances (Figure 1.).

Figure 1. Effectiveness of systems



Source: Own elaboration based on (MacArthur Foundation, 2010; EU, 2012, 2016)

In this sense, the new paradigm of the circular economy is structured in a transversal way by deploying its results throughout the production cycle "the proposed actions support the circular economy at each stage of the value chain, from design, production, to consumption, repair,

reprocessing, waste management and secondary raw materials are reintroduced into the economy" (EC, 2015, p.3).

Goal and Methodology

The design of the research in the first stage is documentary, with descriptive and exploratory scope, the method used to propose the entries for the design and development of the database for this applied research is the review and qualitative analysis of the GRI and the circular economy (EC) which allowed the researchers to identify the dimensions proposed by the GRI, in particular the environmental dimension and, environmental indicators related to the principles of the circular economy (Recycle, Renew, Reuse and Repair).

In the second stage will proceed with the development of the database, central objective of this research, it is proposed to generate a programmable technological platform through the METPROD application presented in Figure 2, which has a software architecture called Model View Controller (MVC). According to Sommerville (2011), the MVC architectural pattern has three logical components, all of which relate to each other. You have the Model component, which works with the data and its operations within the system, the View component allows the way the data is presented to the user and, the Controller component establishes the manipulation by the user. For example: press some specific keys, use the mouse, which will have to go to View and Model.

Findings

The results of the research are presented, which for the purposes of comprehensive research, are considered preliminary. As a result, after the documentary analysis, the articulation of Circular Economy Indicators under the theoretical foundation described versus the GRI indicators in the environmental dimension is obtained. Through the analysis of different groups of CE indicators, the ones that best adapt and contribute to a better qualitative measurement through actions, initiatives or strategies that can be applied in companies will be chosen. It is worth mentioning that the indicators of the GRI and the EC are quantitative and companies are not willing to respond to an instrument of this nature nor have they been evaluated according to these indicators. What is intended with the design of the DB is to facilitate and dispose of the information to develop a diagnosis that allows us to identify the strategies, actions, and initiatives and have a clear vision of the changes that are required to contribute to a circular transition of the actors: governments, private initiative, civil society and citizens in addition to the sectors: primary, secondary and tertiary. It is proposed to measure the circular economy according to the dimensions of the life cycle of products and / or services; in which the structure of the 6Rs: Reduce, Reuse, Recycle and Recover, Redesign and Remanufacture (Jawair, et al., 2016), articulated with the environmental dimension of the GRI, will be considered for the design of the database.

Conclusion

The current trend of the global community is to modify the linear model of consumption for that of the circular economy, which also allows for economic development that reduces poverty levels and increases the well-being and quality of life of the inhabitants without compromising the planet (SEMARNAT, 2019). The development of renewable energies is essential if we want to stop climate change and fight for all the inhabitants of the earth to have electricity; Unlike fossil fuels, renewable energies are inexhaustible, varied and among all of them they are potentially viable anywhere on the planet; But most importantly, renewable energies do not pollute.

In short, the Circular Economy as a sustainability strategy has been gaining momentum in companies and governments in Europe, in particular, in Mexico City, the Circular Economy Law was approved in 2023 which has resulted in environmental opportunities and compliance with the SDGs in terms of lower emissions, Lower consumption of raw materials, preservation and improvement of soil productivity, a reduction of negative external factors, mobility, waste management, clean energy uses, etc. If the government of Mexico makes a diagnosis towards a circular economy, the impact will be felt throughout society and in groups or stakeholders. In short, the researchers consider that locally and regionally the main actors: companies, HEIs, NGOs, local governments, citizens are committed through some strategic actions, initiatives can

facilitate the transition to the new paradigm of EC.

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