

# Scientific Journal of Applied Social and Clinical Science

## METRICS OF THE CIRCULAR ECONOMY IN THE TEXTILE INDUSTRY CASE: TEPEJI OF THE HIDALGO RIVER

---

*Marisol Reséndiz Vega*

``Universidad Tecnológica de Tula-Tepeji``  
Master in Administration, graduated from  
``Instituto Tecnológico y de Estudios  
Superiores Monterrey`` (ITESM), Doctorate  
at the Latin American Technological Institute  
(ITLA)

Orcid = 0000-0001-8199-6548

[https://www.researchgate.net/profile/  
Marisol-Resendiz](https://www.researchgate.net/profile/Marisol-Resendiz)

All content in this magazine is licensed under a Creative Commons Attribution License. Attribution-Non-Commercial-Non-Derivatives 4.0 International (CC BY-NC-ND 4.0).



**Abstract:** It is necessary for the entrepreneur to promote the transition from the linear model of extracting, manufacturing, selling, using and throwing away to revalue the components used in the life cycle of the products. In November 2021, the Circular Economy Law was published in Mexico, however, the concept is not known and sometimes misunderstood, which is why it is necessary to identify the metrics for the application of the CE in the textile sector in Tepeji del Rio., Hidalgo, where the units in this area are relevant to the country's economy. This is a case study where a review of the Ellen MacArthur Foundation model and the metrics proposed in the CE Law in Mexico was carried out. Tours were carried out in the different areas and interviews with company personnel. Among the findings were identified: Environmental education, Work environment, Life cycle analysis (LCA), Carbon Footprint (HC), Water Footprint (HH), Secondary resources, Supply chain, Value chain, SWOT and PESTEL, as the metrics on which the implementation of the circular economy depends. Implementation depends on the context and is proposed to emphasize LCA.

**Keywords:** Circular economy, textile, metrics.

## INTRODUCTION

Textile manufacturing is one of the sectors that has had the most impact on economic and commercial opening since it remained until 2001 as the main supplier of textile products from Mexico to the United States. Since 2007, China and Mexico have maintained strong competition in this market (Chavez & Leyva, 2007).

In Mexico, legal frameworks and public policies have historically been generated, promoting an economy that does not consider environmental and social impacts (externalities of the economy), therefore, production and consumption patterns do not

do so either, and there is inefficiency in the use of natural resources that are neither adequately controlled nor sanctioned (Semarnat, 2016). In 2021, the "Circular Economy Law" was made official in Mexico, which promotes the transition towards a paradigm shift and sustainable use of resources.

In Tepeji del Rio; Hidalgo, we find textile manufacturing companies such as: La Josefina, Kaltex, Vicky Form, Levis, Zaga, Yashiro and Mexica, which require identifying the variables that indicate the current situation and from which an action plan is derived to implement the model of EC.

The General Law of Circular Economy (LGEC) provides that both the Federal Government and the governments of the federal entities, as well as the municipalities and territorial demarcations of Mexico City, will promote the participation of natural and legal persons in the models of Circular Economy, with the purpose of implementing what has been established, defines Circular Economy (CE), as a system of production, distribution and consumption of goods and services, oriented to the redesign and reincorporation of products and services to maintain value and life in the economy. usefulness of the products, materials and resources associated with them for as long as possible, and that the generation of waste is prevented or minimized, reincorporating them again into cyclical or biological production processes, in addition to promoting changes in production and consumption habits and identifying as CE criteria those that promote the reduction of the carbon footprint, the water footprint or the optimization of the use of materials, through the efficient use of natural and economic resources, sustainable consumption and production; reuse, recycling, composting, co-processing or other type of recovery or use. The regulations of said law have not yet been published. In companies in the

textile sector in Tepeji del Río, Hidalgo, they express the need to know what CE consists of, make a diagnosis of their current situation and propose an action plan; given that their commercial clients in other countries demand their application. In this project, it begins with the detection of the metrics to later carry out the diagnosis.

## REVIEW OF LITERATURE

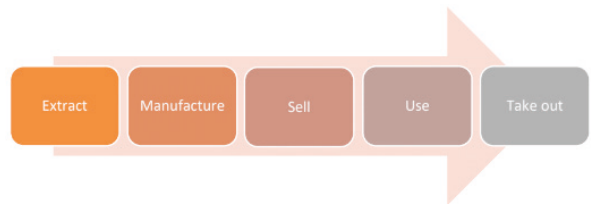
### LINEAR ECONOMY

When studying the causes of the current planetary emergency situation, we must refer to the hyper-consumption of societies, which continues to grow as if the Earth's capacities were infinite (Daly, 1997; Brown and Mitchell, 1998; Folch, 1998 ; García, 1999). It is enough to point out that the twenty richest countries in the world have consumed more nature in this century, that is, more raw materials and more non-renewable energy resources, than all of humanity throughout its history (Vilches and Gil, 2003).

We are depleting resources that will impact the lives of future generations, as stated by the World Commission on Environment and Development (1988): “we are borrowing capital from the environment of future generations, with no intention or prospect of repayment.” There is aggressive advertising that is dedicated to creating needs or stimulating ephemeral fashions, reducing the durability of products and promoting others with a high ecological impact due to their high energy consumption or their polluting effects. The paradigm of comfort is the disposable product that we launch carelessly, ignoring the possibilities of the three “Rs”: reduce, reuse and recycle.

In conclusion, it is necessary to change the paradigm of extracting resources from the environment to manufacture, selling what is manufactured; use the good and finally throw

it away at the end of its use (see figure 1). It is imperative to practice more responsible consumption, away from aggressive advertising that pushes us to purchase useless products.



**Figure 1.** *Scheme of a linear economy.*

Note: Own elaboration

### BACKGROUND OF THE CIRCULAR ECONOMY

The principles of the circular economy model have to do with the provision of mechanisms that are detached from the consumption of finite resources. It is based on three principles, whose purpose is the challenge of innovation in order to be viable.

1. Preserve and enrich natural capital: controlling finite stocks and balancing the flows of renewable resources.
2. Optimize the performance of resources: circulating products, materials and components at their maximum performance in all processes, in biological and technical flows.
3. Ensure the effectiveness of the system: revealing and redesigning to leave out negative externalities.

Different philosophies and models were proposed by various authors in which the environment began to be perceived as a system; Integrating the principles of the General Systems Theory, they perceived that ecosystems should be used, but at the same time preserved, emerging sustainable development that constituted a historical milestone regarding the study of the environmental variable in the economic-

business field; Subsequently, a loop economy is proposed and the consequent impact on job creation, economic competitiveness, resource savings and waste prevention and finally the “circular economy” model of the Ellen MacArthur Foundation emerges, based on an organizational philosophy of systems inspired by living beings are characterized by being regenerative, just as occurs in nature. Its practical applications, both in economic systems and industrial processes, have been increasing progressively in recent years (Costal, 2020).

## CIRCULAR ECONOMY

The idea of a Circular Economy was determined in order to substantially modify the linear system of production and consumption. This economy suggests a change in the guidelines for the manufacture and acquisition of those resources, which attempts to sustain and comfort socioeconomic development, incorporating work in a sustainable manner, without involving eco-systemic functions, protecting natural resources for present and future generations. (Rodriguez, 2017).

The circular economy is a philosophy of systems organization inspired by living beings. Its application consists of designing products without waste (eco design), products that facilitate their reuse, as well as defining socially intelligent business models (Goleman, 1999), to that manufacturers can collect, classify, reuse, recycle and reduce the use of environmental resources. Divide the components of the products into two groups:

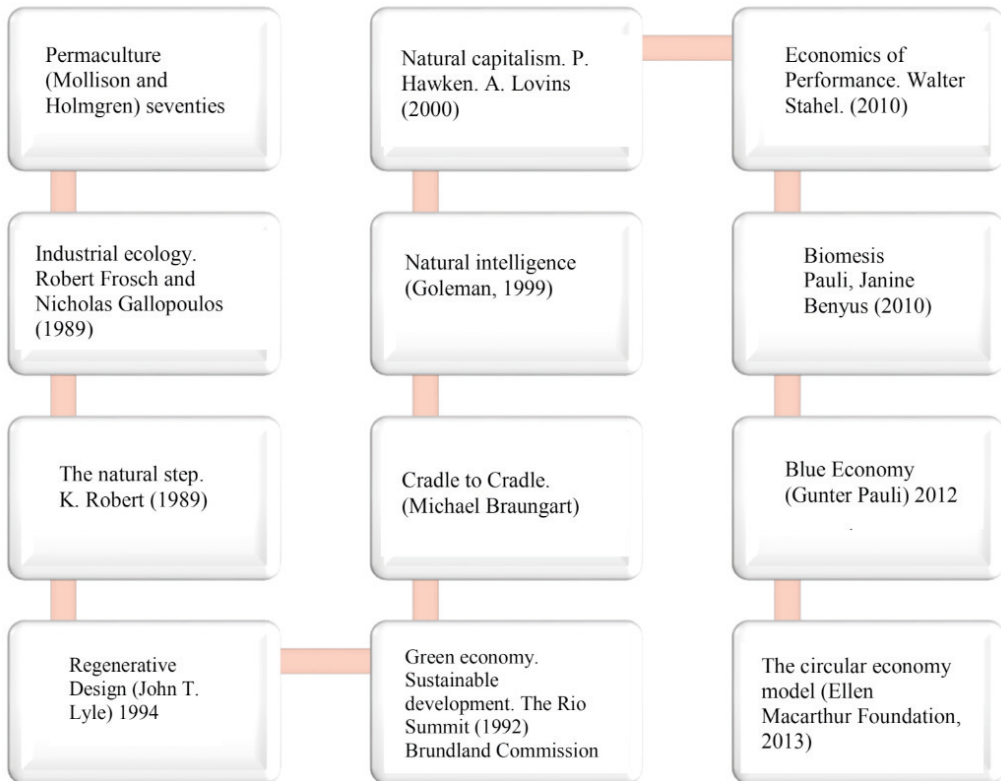
1. Biological nutrients are biodegradable, they are introduced into nature after their use value is no longer profitable.
2. The technical components of the products were designed to be able to be assembled and disassembled a large number of times, and to promote the

reuse of materials and energy savings (Ellen MacArthur Foundation, 2013).

The Cradle to Cradle design philosophy represented the application of the circular economy to the world of eco-design and industrial production. Figure 1 shows the diagram of the circular economy model.

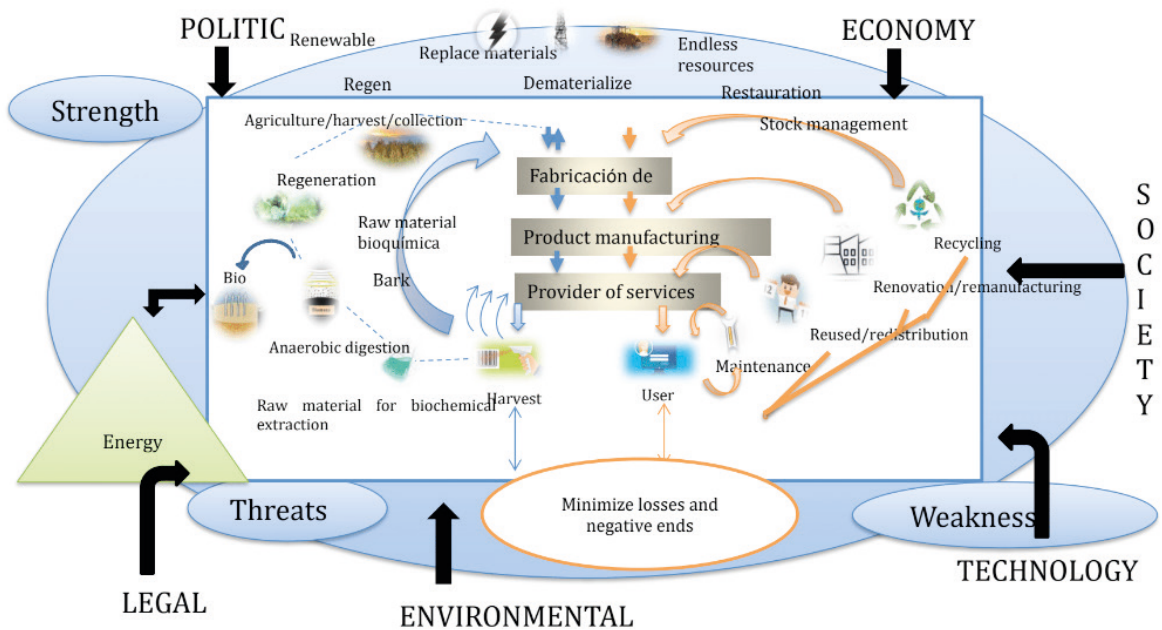
The concept of circular economy comes from various sources of eco-intelligence, which is the ability to live trying to harm nature as little as possible, understand the consequences of actions and decisions on the environment and choose the most beneficial ones for health. of the planet (Ramírez, and Galán, 2012). The circular economy is based on the following principles:

- Waste versus food: the concept of garbage or waste disappeared. Biological components once again became part of natural or industrial cycles with minimal energy consumption. Biological nutrients composed of completely biodegradable materials returned to nature without problems to be integrated into natural processes; Technical nutrients (mainly polymers or alloys) can be reused in a simple and inexpensive way in terms of energy.
- Diversity strengthened the most resistant and resilient natural systems: they are the ecosystems that are composed of a greater diversity of organisms and interactions between them. In the economic field they applied a similar philosophy, to improve responses to economic and productive crises.
- System of interrelationships: the elements of the system are highly interrelated and show non-linear relationships among them; When the system was designed, the internal



**Table 1.** Background of the Circular Economy

Note: Own elaboration based on information from Balboa and Somonte (2014), Ellen MacArthur Foundation. (2015) and Costales (2020)



**Figura 2.** Modelo de economía Circular

Note: Source Own elaboration based on the Model proposed by the Ellen MacArthur Foundation (2015)

and external interrelationships of the elements that composed it were taken into account.

- Reconceptualization of the ownership model: the circular economy opted for the new model in which the technology was rented by the producing company to the user. The manufacturer/producer improved the product from time to time by using/reusing the components of the devices that are becoming obsolete.
- Renewable energies as a source of energy, all energy came from sources that are renewed over time. The circular economy opted for the replacement of fossil and nuclear fuels with renewable energies.
- True prices: prices reflected the real cost of the product to encourage rational consumption.

In the circular economy there are three basic levels of action:

- First level: the organization applies the 3Rs: reduce resource consumption and waste emissions; reuse resources, and recycle components.
- Second level: resources are reused and recycled within eco-industrial parks and chain industries, in such a way that they completely circulate in the local production system.
- Third level: different local production and consumption systems are integrated, resources circulate between industries and urban systems. This level required the local development of collection, storage, processing, and distribution systems, by product.

The effort at the 3 levels influences: the development of resource recovery, cleaner production companies, and public facilities. This produces an increase in the dimension of

economic development through investment in new companies; Therefore, the circular economy offers new business opportunities.

## **WORK HYPOTHESIS**

The circular economy produces a lower level of waste emissions and less use of resources since the products remain in use for as long as possible... (causal hypothesis).

## **GOAL**

Identify the metrics that affect the success or failure of the implementation of the Circular Economy model in the textile sector of Tepeji del Río Hidalgo, to begin a diagnosis of the current situation in the textile sector.

## **RESEARCH QUESTIONS**

Are we prepared for the implementation of the Circular Economy Model? Does our legislation encourage its implementation? Is it just a company decision? How do the new demands on textile materials impact? How does it affect the generation of new waste due to the COVID-19 Pandemic?

## **METHODOLOGY**

This is a mixed study in which a bibliographic review of the Ellen MacArthur Foundation model on Circular Economy was carried out, on the metrics proposed in the CE Law in Mexico and those variables useful in diagnosing the use of resources. Tours were carried out in the different areas and interviews with company personnel in order to collect information and define the variables on which the implementation of the features that characterize the Circular Economy model depends. Once these variables were identified, a specific proposal was made to carry out a diagnosis of the current situation.

## RESULTS AND DISCUSSION OF RESULTS

### ANALYSIS OF THE ELLEN MACARTHUR FOUNDATION MODEL

The circular economy proposes the existence of two material flows: the biological one, which involves all resources composed of organic matter, which after being used can be reintegrated into ecological cycles, and the technical one, referring to the raw materials contained in a product. These should be designed in such a way that they circulate within socioeconomic systems after their useful life to be able to give them a new use and reinsert them into a productive process, with practices related to reuse and recycling as a key strategy (Haas et al. 2005). There are even authors who maintain that increasing the “circularity” of an economy can be key to maintaining materials in the future.

The circular economy is born from the idea that natural cycles do not generate waste: matter flows. The garbage of one organism is recovered and appreciated by another. This idea of “garbage is food” is taken from nature and applied to human technical processes to rethink the way our technologies work, the way we design products and the way the consumer interacts with them. Non-biodegradable products must be designed under a logic of “return and renewal” (Ellen MacArthur, 2015). Products must be designed so that their materials can be reprocessed to create new products as technologies advance.

The circular economy must consider the human factor to achieve the implementation and paradigm shift from the linear economy in which it is extracted-transformed-use and throw away to the circular economy. Within an organization, the interests of all workers coexist and interact, forming a unique work environment; According to Chiang et al, a

good organizational climate is considered to exist when workers carry out their work in a favorable internal environment using their knowledge and skills in a convenient and timely manner (2010).

It is essential to take into account that the results of the company depend, in a high percentage, on the characteristics of the environment in which it operates and the capacity it has to assimilate this environment (Porter, 2006), so it must be considered also in the circular economy model the external context (see table 2).

Transition towards the Circular Economy	
Strengths of the Model proposed by the foundation Ellen MacArthur, 2015	Weaknesses of the Model proposed by the foundation Ellen MacArthur, 2015
Technical cycle	Internal context
Biological Cycle	External context
Renewable energy	Human factor

**Table 2.** Findings when analyzing the application of the circular economy in the textile sector in Tepeji del Río, Hgo.

Note: Source Own elaboration.

### ANALYSIS OF THE METRICS INDICATED BY THE CIRCULAR ECONOMY LAW IN MEXICO

The Circular Economy Law (2021) defines the circular economy as an Economy system of production, distribution and consumption of goods and services, aimed at the redesign and reincorporation of products and services to maintain the value and useful life of the products in the economy., the materials and resources associated with them for as long as possible, and that the generation of waste is prevented or minimized, reincorporating them again into cyclical or biological production processes, in addition to promoting changes in production and consumption habits; proposes as metrics: the water footprint; carbon footprint and material use indicators.

Presents the term secondary raw materials as those materials at the end of their useful life, non-conforming products, or by-products, which are converted into second-use raw materials when separated, stockpiled, and collected or recovered, and are managed and/or marketed. for reuse, recycling, composting or other type of recovery or use, and replace or reduce the use of virgin raw materials (Chamber of Senators, 2021).

It aims to integrate the scavengers into the fiscal formality. It is proposed that municipal governments be responsible for regularizing and integrating them into an official registry, in order to improve working conditions in their facilities and professionalize their activity. It also points out that any natural or legal person whose activity is the manufacturing, processing, production, import or manufacturing of containers and packaging will be required to submit a Circular Economy Plan to Semarnat for registration.

## IDENTIFIED METRICS

Metrics were identified in both the internal and external context.

Within the internal context, it was identified that training is required on topics on the importance of not generating secondary resources or failing that, reducing generation, as well as collecting and channeling them for reuse, recycling, re-manufacturing and the environmental implications.

The work environment is also important, since it is the human resources of a company that define the success or failure of a new project.

An important aspect of the circular economy model is the analysis of the life cycle of the product from its design and from that stage to make the necessary adjustments according to the vision you have about how the resources will be reintegrated into the planet? or to which supply chains will they be

rechanneled? We can use product life cycle analysis (LCA); useful tool in this regard. In the companies under study we found that each stage of the production process is carried out in a different country, there is high fuel consumption and impact on the environment due to transportation, so the carbon footprint and the supply chain are two of the metrics of utility, since its measurement will be a very useful indicator (see table 3 and figure 3).

The company under study manufactures different products and due to seasonal and fashion variations, human capital has developed a high capacity for adaptation to modify its processes and be able to manufacture different designs. It was chosen to carry out the life cycle analysis (LCA) and the Carbon Footprint of the jeans because it is a product that they always still manufacture and the design changes. LCA was identified as a highly relevant tool since it shows the processes in which the greatest impacts occur and allows them to be modified from the design; Its preventive nature, if applied, would lead to the elimination of waste and achieving the principles of the circular economy.

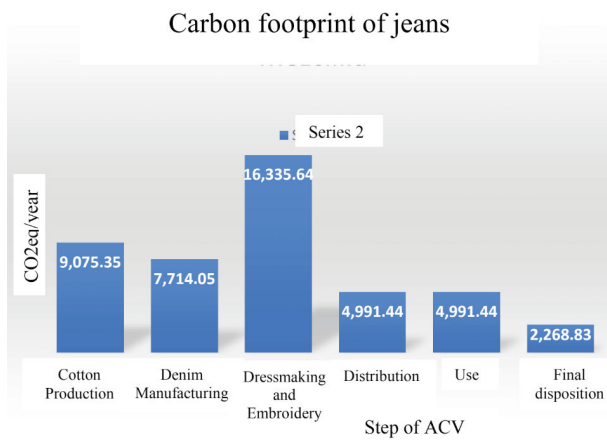
The processes, during the life cycle of the jeans, generated a total of 340.32653 kilograms of CO<sub>2</sub> eq waste. a week. When taking into account the annual production in the clothing and embroidery stage (production), 16,335,648 tons of CO<sub>2</sub>/year would be produced (see figure 3).



Step of ACV	Production and obtaining of cotton fiber	Manufacturing of Denim Fabric	Dressmaking and Embroidery	Distribution	Use	Final disposition
Country where it takes place.	India and others	United States.	Tepeji del Río	E.U.- Tepeji del Río	Several	Several
Ton CO <sub>2</sub> eq/year	9075.35t CO <sub>2eq</sub> /year	7714.05t CO <sub>2eq</sub> /year	16,335.64t CO <sub>2eq</sub> /year	4991.44t CO <sub>2eq</sub> /year	4991.44t CO <sub>2eq</sub> /year	2268.83t CO <sub>2eq</sub> /year
Type of HC	20%	17%	36%	11%	11%	5%
Type of HC	Indirect	Indirect	Direct	Direct/Indirect	Indirect	Indirect
Scope of stroke	Cradle	➔				Tumba

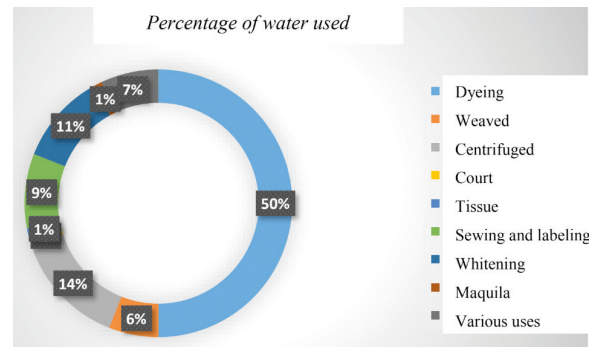
**Table 3.** Scope and stages of the LCA, Country in which it is carried out and HC in Kg of CO<sub>2</sub> eq per stage.

Source: self made



**Figure 3.** Carbon Footprint of Jeans

Note: Own elaboration based on data from the company under study.



**Figure 4.** Water Footprint of the company under study

Note: Own elaboration

Although the circular economy is a concept that is interrelated with sustainability, and whose objective is that the value of products, materials and resources is maintained in the economy for as long as possible, and that generation is reduced to a minimum of waste. It is about implementing a new, circular -not linear- economy, based on the principle of closing the life cycle of products, services, waste, materials, water and energy. It is important for its implementation to develop an initial diagnosis, where the internal and external context is taken into account, as well as metrics such as: HH, ACV, HC; related to the analysis of the use of resources. These last aspects are not included in the original model (Ellen MacArthur, 2013) and it depends on them whether organizations can visualize their current situation and the path to follow in order to design a plan and achieve its

implementation. Likewise, it is important that organizations collaborate with government authorities in adapting the legislation, so that it facilitates application (see table 4 and figure 5).

Internal context
<ul style="list-style-type: none"> <li>•Organizational climate</li> <li>•Training</li> <li>•Value chain</li> <li>•Strengths</li> <li>•Weaknesses</li> <li>•Water footprint</li> <li>•Carbon footprint</li> <li>•LCA of the products</li> <li>•Supply chain</li> <li>•Industry alliances</li> </ul>
External context
<ul style="list-style-type: none"> <li>•Opportunities</li> <li>•Threats</li> <li>•Political environment</li> <li>•economic environment</li> <li>•Social environment</li> <li>•Biotic and abiotic environment</li> <li>•Legal provisions</li> <li>•Supply chain</li> <li>•Infrastructure to recycle, repair, recover, reject, redesign, reduce, restore, re-manufacture and reuse</li> </ul>

Table 4. Variables on which the implementation of the Circular Economy in the Company under Study in Tepeji del Río Hidalgo depends.

Note: Own elaboration according to the results obtained.

## CONCLUSIONS

Metrics behave differently in municipalities, regions, states, countries and industrial sectors, so the implementation of the Circular Economy will be different in different contexts.

Environmental legislation in Mexico must be updated and aligned with the principles of the Circular Economy.

The Climate Change Law; refers and defines a limit for the Carbon Footprint, but there is no Law that refers to the Water Footprint.

Product life cycle analysis is essential to modify the product from its design and have the opportunity to mitigate, prevent or avoid impacts.

Society and the problems that afflict it are dynamic and sometimes difficult to address, such as the COVID-19 pandemic, where survival had to be prioritized over the use of materials and waste generation.

## PROPOSALS

Review and align the General Law of ecological balance and environmental protection with the General Law for comprehensive waste management and the Circular Economy Law. Create and induce a change in the perspective of the human being so that the value of resources is considered and it is not so easy for the user to throw them away.

Put more emphasis in the Circular Economy Law on modifying products from their design to ensure their circularity.

Ensure that secondary resources are used not for the social value created but for the circular awareness acquired.

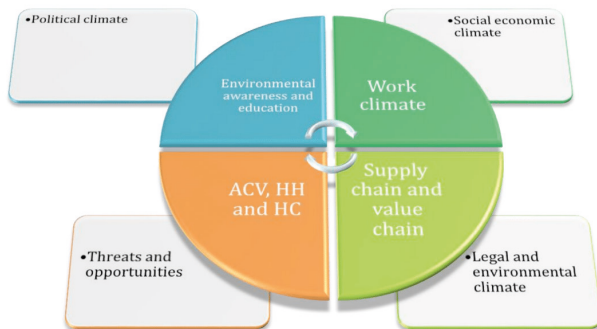


Figure 5. Internal and external context metrics identified.

Note: Own source.

## REFERENCES

- Bálboa C., C. H., & Domínguez Somonte, M. (2014). Economía circular como marco para el ecodiseño: el modelo ECO-3. *Informador Técnico*, 78(1), 82-90. <https://doi.org/10.23850/22565035.71>
- Brown, L. R., y Mitchell, J. (1998): «La construcción de una nueva economía», en Brown, L. R.; Flavin, C., y French, H.: *La situación del mundo 1998*, Barcelona, Icaria.
- Cámara de Senadores (2021). Ley General de Economía Circular (L.G.E.C.). Consultado el 1 de julio, 2022, desde [http://www.diputados.gob.mx/LeyesBiblio/senclave/65/CS-LXV-I-1P-038/01\\_minuta\\_038\\_17nov21.pdf](http://www.diputados.gob.mx/LeyesBiblio/senclave/65/CS-LXV-I-1P-038/01_minuta_038_17nov21.pdf)
- Comisión Europea (2015). Comunicación de la Comisión al Parlamento Europeo, al Consejo, al Comité Económico y Social Europeo y al Comité de las Regiones. COM (2015) 614. Cerrar el círculo: un plan de acción de la UE para la economía circular. Bruselas, Bélgica. Ver: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0614> (consultado el 12-03-2019).
- Comisión Europea (2016), “Informe sobre España 2018”, SWD(2018) 207 final, de marzo de 2018. [https://ec.europa.eu/info/files/2016-european-semester-country-report-spain\\_es](https://ec.europa.eu/info/files/2016-european-semester-country-report-spain_es)
- Costales Torres, A. (2020). Economía circular: Una alternativa rentable y sostenible. (Trabajo de grado de Maestría). Universidad de Sevilla, Sevilla.
- Cordero, A. O. V. (2011). “Cálculo de la Huella de Carbono según la Metodología francesa bilan carbone®: aplicación a la Sociedad de los transportes públicos de la ciudad Limoges S.T.C.L. En el año 2009”. Tesis de maestría. Universidad de Zaragoza, Centro Politécnico Superior (C.P.S). Zaragoza, España
- Chavez, F., & Leyva, L. (2007). México y China : competencia en el mercado de Estados Unidos. *Comercio Exterior*, 57(11), 911–944.
- Chiang, Margarita et al. (2010), Relaciones entre el clima organizacional y la satisfacción laboral, Madrid: Universidad Pontificia Comillas.
- Margarita et al. (2010), Relaciones entre el clima organizacional y la satisfacción laboral, Madrid: Universidad Pontificia Comillas.
- Daly, H. (1997): «Criterios operativos para el desarrollo sostenible», en H. Daly, y R. Schutze: *Crisis ecológica y sociedad*, Valencia, Germania.
- Diario Oficial de la Federación (DOF, 2018). Ley General para la Prevención y Gestión Integral de los Residuos. Última Reforma DOF 19-01-2018.
- De, I., & Emocional, I. (2007). Daniel Goleman : la Inteligencia Emocional en la práctica, 1–3.
- ECODES. (2016). Sistema de Gestión Sostenible. Una Herramienta para la Promoción de la Responsabilidad Social de las Empresas. ECODES. Recuperado el 5 de Agosto de 2016, de ecodes tiempo de actuar: [http://ecodes.org/documentos/Manual\\_Basico\\_SGS\\_11.2006.pdf](http://ecodes.org/documentos/Manual_Basico_SGS_11.2006.pdf)
- Ellen Macarthur Foundation. (2013). The circular model: an overview. Recuperado de <http://www.ellenmacarthurfoundation.org/circular-economy/circulareconomy/the-circular-model-an-overview>.
- Ellen Macarthur Foundation. (s.f.). Hacia una Economía Circular. Ellen Macarthur Foundation. Recuperado de [https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Executive\\_summary\\_SP.pdf](https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Executive_summary_SP.pdf)
- Ellen MacArthur Foundation (2015). Towards a Circular Economy. Business rationale for an accelerated transition. [https://www.werktrends.nl/app/uploads/2015/06/Rapport\\_McKinsey-Towards\\_A\\_Circular\\_Economy.pdf](https://www.werktrends.nl/app/uploads/2015/06/Rapport_McKinsey-Towards_A_Circular_Economy.pdf)

Entrevista con MireilleAcquart, Directora de EthicalFashionSpaece, realizada el 20 de febrero de 2019.

European Union. (2017). Life-cycle in practice. *Life and Circular Economy*, 22.

Fernández Carril, L. “The New Detractors of the Climate Pact” in *Intercambio Climático*. Latin American Platform on Climate. February 5th, 2014.<http://intercambioclimatico.com/en/2014/02/05/the-new-detractors-of-the-climate-pact/>

Folch, R. (1998): *Ambiente, emoción y ética*, Barcelona, Ariel.

Forster, P., & Artaxo, P. (2005). Changes in Atmospheric Constituents and in Radiative Forcing. *Notes*, 18(May 2014).

García, E. (1999). El trampolín fáustico: ciencia mito y poder en el desarrollo sostenible, Valencia, Ediciones Tilde.

Gestión, H. U. N. A., Andrés, L., & López, M. (n.d.). SUSTENTABLE : Cero residuos.

González Ordaz, G. I., & Vargas-Hernández, J. G. (2017). La Economía Circular como factor de la Responsabilidad Social. *Revista coyuntural*, 105-130.

Gobierno fácil (2014-2019). Plataforma de la industria de la moda. ProMéxico. Available at: <http://gobiernofacil.com/proyectos/plataforma-promexico>

Hauschild M. Z., L. C. Dreyer, and A. Jørgensen (2008). Assessing social impacts in a life cycle perspective—Lessons learned. *CIRP Annals—Manufacturing Technology* 57, 21–24. doi: 10.1016/j.cirp.2008.03.002, ISSN: 0007–8506.

Huppes G. 1996. LCA yesterday, today and tomorrow. Centre of Environmental Science (CML).Leiden University, The Netherlands.

Instituto Nacional de Estadística y Geografía (2018). Sistema de Cuentas Nacionales de México Fuentes y metodologías. Año base 2013 Sistema de Cuentas Nacionales de México Fuentes y metodologías. Año base 2013. México. Available at: [https://www.inegi.org.mx/contenidos/programas/pibact/2013/metodologias/METODOLOGIA\\_CBYSB2013.pdf](https://www.inegi.org.mx/contenidos/programas/pibact/2013/metodologias/METODOLOGIA_CBYSB2013.pdf)

IPCC 4th Assessment Report, 2007: [http://www.ipcc.ch/publications\\_and\\_data/publications\\_ipcc\\_fourth\\_assessment\\_report\\_synthesis\\_report.htm](http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm)

ISO. 1997. ISO 14040: Environmental management – Life cycle assessment – Principles and Framework. Geneva, Switzerland.

ISO. 1998. ISO 14041: Environmental management – Life cycle assessment – Goal and Scope Definition and Inventory Analysis. Geneva, Switzerland.

ISO. 1999. ISO 14.042 Environmental management – Life cycle assessment – Life cycle impact interpretation. Geneva, Switzerland

ISO. 2003. ISO TR 14047. Gestión medioambiental. Análisis del ciclo de vida. Ejemplos para la aplicación de ISO 14042.

Jagodzinski, Romuald & Stracke, Stefan & Kelemen, Melinda & Neumann, Laszlo. (2006). Case Study General Motors Europe.

Jeremy Willams (2014). Four Principles of the Circular Economy. Make Wealth History. Available at: <https://makewealthhistory.org/2014/02/06/four-principles-of-the-circular-economy/>

LGCC (2019) Ley General de Cambio Climático Diario Oficial de la Federación, 6/6/2012, en: [http://www.diputados.gob.mx/LeyesBiblio/pdf/LGCC\\_130718.pdf](http://www.diputados.gob.mx/LeyesBiblio/pdf/LGCC_130718.pdf) [Consulta: 20/9/2022].

Mireille Acquart and Federico Arce, Ethical Fashion Space (2019), Actors in the fashion [and] textile sectors for the transition to models of production based on the Circular Economy. [https://www.cemda.org.mx/wp-content/uploads/2019/08/CEM\\_moda\\_publicaci%C3%B3n\\_ingles\\_FINAL.pdf](https://www.cemda.org.mx/wp-content/uploads/2019/08/CEM_moda_publicaci%C3%B3n_ingles_FINAL.pdf)

Porter, M. E. (2006), *Ventaja Competitiva (edición revisada) creación y sostenimiento de un desempeño superior*. Editorial Continental, cuarta reimpresión, México 2006

ONU. (septiembre de 2015). *Objetivos de Desarrollo Sostenible*. Obtenido de Organización de las Naciones Unidas: <https://www.un.org/sustainabledevelopment/es/sustainable-consumption-production/>

Rámirez, E., & Galán, L. (2006). El Ecodiseño Como Herramienta Básica De Gestión Industrial. *XVIII Congreso Internacional de Ingeniería Gráfica*, 162(July), 1–6. <https://doi.org/10.13140/RG.2.1.1870.0885>

Rodríguez, C. y, & Fernández, L. (2006). Manufactura textil en México: Un enfoque sistémico. *Revista Venezolana de Gerencia*, 11(35), 335–351. Retrieved from <http://www.redalyc.org/articulo.oa?id=29003502>

Rodríguez, J. M. (2017). *Economía circular, un principio sin fin*. Secretaría de Economía. Economía para todos. Textil y Vestido. Available at: <http://www.2006-2012.economia.gob.mx/economia-para-todos/abc-de-economia/mercado-interno/365-textil-y-vestido>

Semarnat (2007). «¿Y el medio ambiente? Problemas en México y el mundo.». México. Archivado desde el original el 22 de noviembre de 2015. Consultado el 6 de octubre de 2016 Obtenido de: [www.semarnat.gob.mx](http://www.semarnat.gob.mx)

Semarnat (2016), Informe de la Situación del Medio Ambiente en México. Compendio de Estadísticas Ambientales. Indicadores Clave, de Desempeño Ambiental y de Crecimiento Verde. Edición 2015. Semarnat. México.

Semarnat. (19 de mayo de, 2019). Recolectan trabajadores de Semarnat 160 toneladas de residuos durante jornada de limpieza. [Comunicado de prensa]. Recuperado de <https://www.gob.mx/semarnat/prensa/recolecta-semarnat-106-toneladas-de-residuos-durantes-jornada-de-limpieza>

Semarnat (6 de febrero de 2019)., Visión Nacional Hacia una gestión Sustentable. Boletín. [https://www.gob.mx/cms/uploads/attachment/file/435917/Vision\\_Nacional\\_Cero\\_Residuos\\_6\\_FEB\\_2019.pdf](https://www.gob.mx/cms/uploads/attachment/file/435917/Vision_Nacional_Cero_Residuos_6_FEB_2019.pdf)

Senado de la República (2021), Proyecto de decreto por el que se expide la Ley de Economía circular, Minuta 038 (17 de Noviembre 2021). Mexico. [https://www.diputados.gob.mx/LeyesBiblio/senclave/65/CS-LXV-I-1P-038/01\\_minuta\\_038\\_17nov21.pdf](https://www.diputados.gob.mx/LeyesBiblio/senclave/65/CS-LXV-I-1P-038/01_minuta_038_17nov21.pdf)

Udo de Haes H.A. Jolliet O. Finnveden G. Hauschild M. Krewitt W. Muller-went R. 1999. Best available practice regarding impact categories and category indicators in life cycle impact assessment – background document for the second working group on life cycle impact assessment of SETAC-Europe (WIA 2). *International Journal of Life Cycle Assessment* 4 (2).

Vilches, A., y Gil, D. (2003): *Construyamos un futuro sostenible. Diálogos de supervivencia*, Madrid, oei / Cambridge University Press