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Social Actors and Management of the Circular Economy in the State of Chihuahua, Mexico

Actores sociales y gestión de la economía circular en el estado de Chihuahua, México

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ABSTRACT

The article analyzes the participation of social actors in the management of the circular economy of urban solid waste in the state of Chihuahua, Mexico. The methodology consisted of semi-structured interviews, virtual interactive workshops (with the implementation of electronic surveys), surveys of municipal governments representatives, and personal communications. The results show that social actors barely glimpse the economic, social, and environmental meaning of betting on the circular economy. The article contributes to the analysis of the circular economy paradigm as a current sustainability tool. It is concluded that little has been studied about the circular economy in Mexico and that the participation of non-state actors has not been valued and used efficiently. The article reflects on what should and can be done with solid waste in Mexico in the future.

Keywords: 1. environmental sustainability, 2. entrepreneurs, 3. solid waste, 4. local legislation, 5. federated states.

RESUMEN

En el artículo se analiza la participación de los actores sociales en la gestión de la economía circular de los residuos sólidos urbanos en el estado de Chihuahua, México. La metodología consistió en entrevistas semiestructuradas, talleres interactivos virtuales (con aplicación de encuestas electrónicas), encuestas a representantes de gobiernos municipales y comunicaciones personales. Los resultados muestran que los actores sociales apenas vislumbran el significado económico, social y ambiental de apostar por la economía circular. El artículo contribuye con el análisis del paradigma de la economía circular como herramienta actual de la sostenibilidad. Se concluye que el concepto de economía circular ha sido poco estudiado en México y que la participación de los actores no estatales no ha sido valorada ni utilizada eficientemente. El artículo reflexiona en torno a lo que se debe y puede hacer con los residuos sólidos en México en el futuro.

Palabras clave:1. sustentabilidad ambiental, 2. empresarios, 3. residuos sólidos, 4. legislación local, 5. estados federados.

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INTRODUCTION

Circular economy involves generating a wide range of materials, commercializing them, and then integrating them into the system, maximizing the number of times they can be used (De Miguel et al., 2021). This process necessarily requires social commitments throughout the chain of custody in the supply chain of these materials and the transformation processes that ultimately provide better economic and social levels for all participants. Such commitments can be strengthened to the extent that social actors see themselves as agents of change in the information and communication era (Castells & Himanen, 2016), which proposes a less governmental model more associated with the private and social sectors (Aguilar, 2006), allowing interested actors to join a complex management process.

Mexico has joined this global management trend with the proposal of the General Law of Circular Economy (Ley General de Economía Circular) of 2019. Through this legislation, the country is transitioning from a linear to a circular economy, aiming to reduce, recycle, and reuse products, thereby mitigating environmental impact and, more importantly, strengthening its economy (Monreal Ávila & Bolaños-Cacho Cué, 2019). A precedent that lays the groundwork for this regulatory proposal is the General Law for the Prevention and Comprehensive Management of Waste (Ley General para la Prevención y Gestión Integral de los Residuos [LGPGIR]), published in Decree n.n. of 2003, which allows non-governmental actors to contribute to comprehensive waste management. More than 20 years after its enactment, the management can be summarized by two unfortunate phenomena: 1) solid waste continues to threaten the environment and human health due to its high generation and accumulation, and 2) there is a certain inertia in maintaining a legal and institutional framework rooted in command and control that does not address the underlying problem.

In relation to the first phenomenon, there is an observed accelerated growth in the generation of both municipal solid waste (MSW) and special management waste (SMW), particularly in urban and metropolitan centers. Between 1950 and 2012, the daily volume more than tripled, increasing from 300 to 990 grams per inhabitant on average (SEMARNAT, 2014). Currently, the national average fluctuates at 1.2 kg (Hernández et al., 2016; CEPAL et al., 2020; SEMARNAT, 2019a).

Currently, 87% of solid waste in Mexico is disposed of in open-air dumps, and only 13% is confined to sanitary landfills (SEMARNAT, 2019b) under the Official Mexican Standard (Norma Oficial Mexicana) NOM-083-SEMARNAT-2003 (SEMARNAT, 2004), with just 9% of these being effectively utilized or recycled (SEMARNAT, 2018). Ultimately, the prevailing focus of local governments remains on resorting to sanitary landfills as the primary solution to address “the issue.”

On the other hand, basic linear management is known as the process from the generator to a final site with little or no utilization of materials and energy, and with negligence in depositing the contaminating waste from households (Wilson & Rathje, 1989, as cited in Bernache, 2023). This perspective results in domestic municipal solid waste not being valorized, and its hazard not determined when deposited in sanitary landfills under regulation, even less so when disposed of in

an unauthorized open-air dump. As a result, there is limited public or private interest in establishing management schemes that could eventually strengthen a circular economy framework.

In the context of the second issue, which pertains to governance and control, it is evident that there is limited progress in local regulations. Approximately 20% of municipalities barely have sanitation regulations, and only 10% of these municipalities have specific programs in this regard (Jiménez, 2015). Similarly, despite having laws and regulations stemming from the LGPGIR, federated states cannot establish the programs suggested by this law. It is also documented that 90% of low-population rural municipalities do not implement comprehensive solid waste management programs (Rosas & Gámez, 2019). This lack of implementation is primarily due to financial constraints, the geographical dispersion of their communities, and the absence of a robust institutional framework for effective public management in this context.

In this way, the integrated management, in which the circular economy should be embedded, is called into question, casting doubt on the short-term establishment of this public policy in urban and rural communities across the country. Hence, research questions arise: To what extent can social actors, including the government, be involved in the management that ensures the circular economy of municipal solid waste? What is the current level of knowledge and commitment among these social actors to embrace the circular economy model? In light of the above, the objective of this study is to analyze the participation of social actors in the management of the circular economy of municipal solid waste.

The article is divided into three sections. The first section presents the background and framework, encompassing legal, institutional, and modern governance aspects, within which social actors can potentially navigate in the country to engage, if at all, in the realms of the circular economy. The second section extensively describes methods and techniques for approaching key actors. The third section presents the results, aligning with the stances and perspectives of local actors regarding the management of the circular economy. Lastly, conclusions are presented.

BACKGROUND AND FRAMEWORK

Regarding green economy, in the document ‘Future We Want’, number 60, the following is established:

> We acknowledge that green economy in the context of sustainable development and poverty eradication will enhance our ability to manage natural resources sustainably and with lower negative environmental impacts, increase resource efficiency and reduce waste (Naciones Unidas, 2012, p. 18).

Circular economy emulates nature in the sense that everything generated as material can eventually be absorbed by it. It involves processes of generation, assessment, and maximum utilization of any material. It operates in contrast to the linear economy, as stated by Martínez & Porcelli (2018):

> it subordinates economic and social systems to the environment, not the other way around, as the linear economic system subordinates nature to economic dictates [...] it focuses on ethics, social equity, sustaining ecosystems and nature, relegating economic interests to a secondary role (p. 314).

In addressing this purpose, the Mexican state articulates its stance in Article 20 of the Regulation of the LGPGIR (Reglamento de la LGPGIR of 2014), designating management plans as a crucial component of integrated waste management. These plans provide specific instructions to each waste generator on 'the way in which the minimization of the quantity, valorization, or utilization of waste will be carried out' (p. 6). The determination of waste subject to management plans takes into account both the high economic value of the waste and the volume of its generation (Decree n.n. of 2003). In addition to this reference, noteworthy changes were introduced in 2013 to the General Law of Ecological Balance and Environmental Protection of 1988 (Ley General de Equilibrio Ecológico y Protección del Ambiente de 1988*;* LGEEPA) (Decree n.n. of 1988) reflecting a certain alignment with the principles of the circular economy. For instance, Article 141, was amended to state that

> the Ministry, in coordination with the Ministries of Commerce and Industrial Promotion and Health [Secretarías de Comercio y Fomento Industrial y de Salud], will issue Official Mexican Standards for the manufacture and use of packaging for all types of products, whose materials enable the reduction of solid waste generation (p. 4).

In prioritizing environmental considerations over economic and social aspects, progress has been observed, notably with the prohibition of single-use plastic bags and straws. This change, while controversial, has made an impact in urban and metropolitan areas such as Mexico City (SEDEMA, 2021), Ciudad Juárez, Chihuahua (Decree 1285/2013 II P.0. of 2014), and Cancún, Quintana Roo (Decree 337 of 2019).

On the political front, the approach to modern governance has, to some extent, determined the soft subordination of economic interests to social and environmental ones. Governance, indeed, represents a continuous decision-making process achieved through the consensus of diverse actors within a specific territory (Mayntz, 2005). Each actor recognizes the need for others to move forward,[2] thus establishing collective goals (Ruano, 2010). The blending of the public and private spheres occurs seamlessly (Kooiman, 2005), and, most importantly, it establishes ongoing relationships of coordination and cooperation among actors (Conejero, 2005), fostering responsible attitudes focused on the use of technology, media, and environmental education (Justice Kofi et al., 2021; Vidarte Rodríguez & Colmenares López, 2020; Wahid et al., 2012; Priess, 2012).

In this way, the solution focuses on instilling, to some extent, attitudes deep within each actor that favor dialogue and care for the environment to yield tangible benefits. In the case of Mexico,

[2] An example of this is that national states, on their own, cannot resolve the issue of public services (Pírez, 1999).

the need for each actor to assume specific responsibility is evident. Indeed, the LGPGIR, in Article 34, speaks of "a social co-responsibility [that] requires the joint, coordinated, and differentiated participation of producers, distributors, consumers, users of by-products, and the three levels of government as appropriate" (Decree n.n. of 2003, p. 6). This aligns with the Sustainable Development Goals (SDGs) proposed by the United Nations (UN) in the 2030 Agenda, specifically addressing industry, innovation, and infrastructure, as well as responsible production and consumption.

The above establishes a solid legal foundation in terms of governance; what is needed is to unite wills through exercises of public deliberation and, in this way, aspire to a change that ensures environmental sustainability and improves the economy of certain sectors. Technological change is progressing favorably and rapidly, alongside the use of global media, and particularly the opportunity to substantially reduce the generation of solid waste causing high entropy. Simultaneously, valorizing these wastes and reintegrating or incorporating them into the economic system is becoming increasingly feasible (Arroyo, 2018; Prieto et al., 2017; Rivera & Martínez, 2021; Rosas & Gámez, 2019; Schneider et al., 2017; Wielgosiński et al., 2021). However, individual willingness is generally gained when there is a tangible incentive for those participating in that collective effort. According to García (2016), with the ideal of the circular economy, "not only would environmental protection be strengthened but also job creation, innovation, and ultimately provide Europe with a competitive advantage in the global market" (p. 2). The UN, on its part, sees the COVID-19 pandemic as an opportunity for job recovery in developing countries like Mexico. This international organization expects the market for returnable packaging worldwide to grow from 37 billion dollars in 2018 to 59 billion dollars in 2026 (Albaladejo et al., 2021).

The new General Law of Circular Economy (Ley General de Economía Circular) supports this objective, anticipating an increase in the recycling percentage of still useful materials. However, certain realities in waste management underscore the significant challenges of adhering to legal regulations in this field. Notable progress has been made in the management of plastic, particularly food-grade packaging, constituting approximately 10% of municipal solid waste. In 2002, only 5% of PET (Polyethylene Terephthalate) containers were being recovered; by 2014, 57% of this waste was reclaimed. This improvement can be attributed to the efforts of major generating companies operating under the civil association Economy and Business Commitment (Economía y Compromiso Empresarial [ECOCE], 2015).

This is evident in the management carried out, for example, in Ciudad Juárez, where a certain level of progress is observed in addressing the issue, but it has not yet reached the realm of the circular economy. In this case, the collection and confinement of MSW based on the Official Standard NOM-083 are concessioned to the company Promotora Ambiental (PASA). Simultaneously, the company BIOGAS has been granted the concession to utilize methane gas from macro-cells to generate electricity, yielding satisfactory results for both the municipal

administration and the citizens (Córdova et al., 2006; Couto et al., 2012).[3] It is also worth noting the contribution made by scavengers in the landfill, which has existed since before it was regulated (municipal official 2, personal communication, February 25, 2021). These latter actors, as relevant economic agents embedded in the partisan political field, contribute in any case to self-employment and recycling, which are inherent elements of the circular economy (Florisbela & Wehenpohl, 2001; Navarrete & León, 2005; Guzmán Chávez & Macías Manzanares, 2012; Bernache & Sobarzo, 2019).

METHODOLOGY

Strengths, obstacles, and opportunities for the implementation of the circular economy for municipal solid waste are identified in the state of Chihuahua. This work addresses the involvement of different social sectors and their interaction with other actors to resolve a pervasive issue and generate governance from a phenomenon that the governmental sector cannot resolve on its own. To achieve the central objective, documentary research and direct engagement with actors involved in solid waste management in the state of Chihuahua were conducted. An important source of this information was obtained through semi-structured interviews derived from four virtual participatory workshops (VPWs), an electronic survey within the same VPWs, a survey of officials from various municipalities in the state, and personal communications with key informants from the same state.

In the VPWs, 324 participants from various social sectors took part, representing the three regions into which the territory of the state of Chihuahua was divided: north, central, and south. Additionally, a special VPW was conducted with environmental managers from the Maquiladoras Association of Juárez (Index-Juárez). The northern region, which shares a border with the United States, is distinguished as an export-oriented maquiladora industrial zone, predominantly inhabited by a significant conglomerate of the population from Ciudad Juárez. Consequently, it is classified as an urban and metropolitan area. On the other hand, the central region, centered around the state capital, is considered an industrial zone housing both export-oriented maquiladoras and national industry and agro-industry. This zone is predominantly populated by the city of Chihuahua, also classified as urban and metropolitan. The southern region is regarded as agro-industrial, given the presence of medium-sized cities and a substantial number of rural municipalities, placing its territory in the categories of urban, metropolitan, and rural areas.

In this process, 245 individuals participated in an electronic survey conducted within the three VPWs.[4] Each workshop formed three working groups for each zone: 1) academics, professionals,

[3] PASA operates with a staff of 380 employees, of which nearly 90% were previously employed by the Department of Cleanliness (Departamento de Limpia). Their prior experience as workers and supervisors contributed to the improved operation of the concessioned service (Couto et al., 2012).

[4] The survey, facilitated by the Zoom communication platform, served as an alternative to gather opinions on the subject of the circular economy. This virtual exercise consisted of a set of specific questions, such as: How important is it for you to have waste management plans in your activities? The platform provides

and civil society organizations; 2) generators and service providers; and 3) government actors. Parallel to this virtual exercise, interviews were conducted with key actors, utilizing questions to encourage dialogue related to integrated waste management and the circular economy. The interviews were conducted based on the content analysis technique. Personal communications significantly contributed to understanding local plans and programs on solid waste and the daily management of the relevant waste.

RESULTS

The General Law of Circular Economy establishes, among other things, shared responsibility plans and the operating entities of the circular economy, whose definitions are:

> Operating Entity: a public or private associative entity with its own assets and legal personality, created for the provision of services within a secondary economic chain;
>
> [...] Shared Responsibility Plan: an administrative tool based on shared responsibility among the manufacturer, distributor, and user of a good or service, which, in collaboration with different levels of government, seeks to minimize the environmental, economic, and social impact derived from the consumption of a good or service (Monreal Ávila & Bolaños-Cacho Cué, 2019, p. 29).

In the execution, "producers, distributors, consumers, and users will participate jointly, coordinated and differentiated, under a scheme of environmental, technological, economic, and social feasibility and efficiency" (Monreal Ávila & Bolaños-Cacho Cué, 2019, p. 31). In this regard, local perspectives and consensus are essential to understand the scope that waste management can have. To this end, a comprehensive report was prepared on various exercises applied to different actors involved in solid waste management in the territory of the state of Chihuahua. The report presented, among other things, the knowledge, interest, and achievements of these actors regarding the management of municipal solid waste and special waste. This serves as a reference for the commitments that may arise from the establishment of the circular economy in the state.

A first exercise was the survey applied to municipal officials, revealing unequivocally that there is a significant difference between rural and urban municipalities in this federated state. In rural areas, waste generation is relatively low, barely reaching an average of 0.6 kg per person per day, while in urban and metropolitan areas like Juárez, the generation is high, with an average of 1.2 kg per person per day. The concern in both cases focuses on clandestine open dumps, where evidently there is no commitment from certain actors to environmental care, let alone addressing matters related to the circular economy.

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multiple options to answer the questions within a specified time. Subsequently, participants can view the tabulated responses, and the process moves on to the next question. It is worth noting that all participants were expected to answer the survey, unless the allocated time was insufficient.

An example of coordinated attention and successful management is the case of the collection and disposal of waste tires in urban centers in the municipality of Juárez.[5] Indeed, starting from 2003, the Mexican government, with support from the U.S. government (both acting as facilitators), engaged in a management led by the Mixed Composition Waste Management Group (Grupo de Manejo Integral de Residuos de composición mixta) (government-society) to determine that the best alternative was the co-processing of waste tires in cement kilns (Córdova & Romo, 2012).[6]

A second exercise was a meeting with members of the Index-Chihuahua association,[7] where the interest of the export business sector in advancing integrated management and achieving favorable levels of coordination around the circular economy was evident. This sector is aware that government management in terms of the efficiency of its processes and requests is crucial for progressing towards any circular economy goal. In this regard, they expressed that the use of electronic platforms to expedite and make management more transparent is fundamental for them.

A third exercise involved a conversation with advisors from the Ecology Commission of the state congress,[8] where the issue of management plans requested by the authority—according to the 2014 Regulation of the General Law of Circular Economy—was highlighted as a key instrument contributing to the circular economy. Among the requirements of this Regulation, it is emphasized that explicit recognition be given to the authority implementing practices related to this purpose, that points contributing to environmental sustainability be strengthened—such as the effective application of the State Law on Integrated Waste Management of the State of Chihuahua (Ley Estatal de Gestión Integral de Residuos del Estado de Chihuahua) (Decree 1285/2013 II P.O. of 2014)—and especially, that a policy be maintained for reducing single-use plastic bags and using straws made of rapidly biodegradable materials.

A fourth exercise involved meetings with municipal officials, where some positions related to integrated management were identified, but there was still a leaning towards the linear economy. Most informants pointed out operational difficulties in collection and final disposal, and only a few addressed issues such as waste prevention and the prevailing legal framework. In the case of the municipality of Chihuahua, for example, the most concerning issues are the termination of

[5] It is noteworthy that each driver in Ciudad Juárez consumes 2.08 tires per year (Córdova & Romo, 2012), and there is a vehicle registry of 550 000 units in circulation, indicating a generation of over one million waste tires.

[6] The Integral Waste Management Group (Grupo de Manejo Integral de Residuos; GMIR), the local cement company, and authorities from both sides, in this case, the EPA (Environmental Protection Agency of the United States) and the Ministry of Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales [SEMARNAT]) of Mexico, are involved.

[7] Association of maquiladoras in the city of Chihuahua.

[8] In February 2021, two Zoom meetings were held with Laura González, Valente Chacón, and Cinthia Villarreal, advisors of the Ecology Commission of the Ecologist Green Party of Mexico (Comisión de Ecología del Partido Verde Ecologista de México; PVEM).

concession contracts with seven private companies that collect 60% of urban solid waste. The remaining waste from public spaces and households, including unused furniture and appliances, is handled by the local authority (municipal official 5, personal communication, April 28, 2021), and the end of the useful life of the landfill operating under the official standard NOM-083 for the past 20 years.

Indeed, opinions on the circular economy are erratic, as one official states, "maybe something can be achieved in closed neighborhoods of the city where, if anything, waste can be separated into valuable and non-valuable" (municipal official 5, personal communication, April 28, 2021). In the case of the municipality of Juárez, the concern revolves around the lifespan of the landfill[9] and the exploitation of its biogas for electricity generation (municipal official 3, personal communication, February 28, 2021). Secondarily, the public agenda leans, if at all, towards the formal recycling issue through concessions with private companies.[10] In this regard, attempts to establish recycling companies next to the landfill have failed. In the rural municipality of Rosales, attention has focused on maintaining the concession for the total management of its waste with the private company and the operation of the intermunicipal landfill that benefits 290 000 inhabitants from the municipalities of Delicias, Meoqui, Julimes, Rosales, and Saucillo, Chihuahua (municipal official 4, personal communication, March 16, 2021).

A fifth exercise involved the implementation of VPWs, where discussions at different tables with various actors were insightful. Firstly, at the table for academics, professionals, and civil society organizations, there was extensive discussion about transitioning from basic waste management, which involves collecting and disposing of garbage on the outskirts of an urban center, to circular economy management. This exercise revealed a specific narrative related to the circular economy, where citizen participation is crucial for implementing local projects, and responsibility extends to both small and large waste generators. It was also emphasized that environmental culture forms the foundation and direction of policies in both public and private spheres. Additionally, the need for inter-institutional coordination to determine the destinations of each byproduct in the market was highlighted. This undoubtedly indicates a potential quick understanding of measures aimed at eliminating waste, maximizing material reuse, and regenerating natural systems.

[9] There is ample capacity in the landfill where between 1 400 to 1 600 tons of waste enter daily, including approximately 700 tons of special handling waste. Regarding the type of garbage, a PASA truck usually unloads 50% paper and cardboard, 20% plastic (PET), and 10% metal; the rest consists of other waste, including organic waste (municipal official 2, personal communication, February 25, 2021).

[10] The Bestway company burned down, and there is no longer any on-site recycling company. Only around 100 independent waste pickers collect the garbage in the unloading areas when the IVASA company gives them the "opportunity" before moving the waste and burying it in the corresponding landfill cell. The Cooperative and Materials Selection Society (Sociedad Cooperativa y Seleccionadora de Materiales [SOCOSEMA]), led by "El mono," no longer exists (municipal official 2, personal communication, February 25, 2021).

At the table for waste generators and service providers, concerns were raised about the administrative challenges posed by public management in terms of the control required for it to be integrated and lead to circular economy processes. Simultaneously, attention must continue to be given to fundamental tools for efficient management, such as management plans, shared responsibility plans, or the establishment of operating entities.

At the government table, there were significant discrepancies due to some differences among the municipal governments in the southern region of the state. In this area, there is a belief, held by both authorities and the population, that having the waste service concession means that the solid waste problem has been solved. In other words, they only follow the linear economy approach, which focuses solely on the collection, transport, and final disposal of generated waste.

A sixth exercise was the online survey conducted—through the Zoom platform —in the VPWs of the three regions of the state and with the environmental managers of Index-Juárez. The survey revealed five relevant points: 1) it was identified that scrap tires are a widespread problem throughout the state but, at the same time, represent an opportunity for utilization; 2) there is sufficient infrastructure in urban-metropolitan centers for the management of solid waste in terms of final disposal, and it is possible to increase recycling, but it is up to the authorities to lead these activities; 3) regarding the separation of urban solid waste and special handling waste, there was general approval, but it was recognized that there is little that can be done regarding waste sorting at home; 4) concerning special handling waste with some commercial and industrial value, it was concluded that these could be utilized in their municipality or city; in this regard, the surveyed actors had coinciding opinions. It was considered that in the northern and central zones, it is scrap tires, while for actors in the southern zone, in addition to scrap tires, there are other special handling wastes such as walnut shells and wood, corresponding to the predominant productive activities in this area: agriculture and forestry. In the case of Index-Juárez participants, representing the maquiladora industry, the preference for utilization was for electronic waste, automotive plastics, and scrap tires, which are related to the predominance of export industrial activities in the central and northern zones of the state.

CONCLUSIONS

According to the results of this research, for most of the social actors considered in this work, including the government, the circular economy is not part of the discussion; rather, it is seen as a distant goal. For now, the objective is to collect and confine the majority of the waste generated, both in rural and urban communities, and, if possible, to utilize some waste based on isolated initiatives from certain private sector actors.

Regarding the questions that guided this research, the responses indicate that social actors only glimpse the economic, social, and environmental significance of embracing the circular economy. However, while the actors demonstrate some knowledge of the concept, the commitment they assume is directed towards the effective and efficient management of generated waste and its

confinement in authorized locations. Therefore, the adoption of a circular economy model appears to be distant.

Governance and the interaction of actors in continuous communication, essential for the implementation of the circular economy, are far from being evident in the management of solid waste in the state of Chihuahua, and one could say, throughout the country. On one hand, the government supports a vertical command and control management related to the linear economy. On the other hand, non-governmental actors, especially entrepreneurs compelled by environmental laws, market needs, and the recent shortage of raw materials indirectly caused by the pandemic, seek new paths and are willing to engage in dialogue to reach consensus. In any case, the government and other actors must adhere to the guidelines of the LGEEPA (Decree n.n of 1988) and the LGPGIR (Decree n.n of 2003) that encourage the shift towards environmental sustainability through extended responsibility, waste management planning by major generators, and the integration of the circular economy concept into the national legal framework. In this way, it is recognized that effort has been made, but not enough to consider that there is solid progress towards the circular economy.

This article has demonstrated the value of the contributions from social actors, participants in workshops, and other deliberative dynamics. Through their participation, they express an interest in their environment, sharing their experiences and proposing alternative solutions. For instance, in the context of separating MSW from households, it is acknowledged that starting from scratch and implementing changes are necessary to make progress in the field of the circular economy. Indeed, eliminating waste from packaging design requires individuals to refrain from consuming products that generate pollution.

In addition to the points mentioned above, the shift could also occur with persistence in three aspects that support the circular economy, namely: a) waste generation and the market are concentrated in urban and metropolitan municipalities; b) there is willingness on the part of actors from various social sectors to participate in public management to implement the circular economy; and c) local government public management areas must expand to have the capacity to regulate the entire process and lead public management.

Regarding the first aspect, it is acknowledged that large cities like Juárez and Chihuahua have the greatest advantages in terms of equipment and infrastructure. They also operate under a public-private administration and management scheme that, to some extent, has yielded favorable results in terms of waste disposal. These cities have maintained a series of concessions with private actors ranging from collection to final disposal. However, this should not be the end but rather a transition towards minimizing waste generation, valorization, and full utilization of waste, as seen in many countries where waste is not a problem but rather part of economic, social, and environmental management systems. In the municipality of Juárez, around 1% of the 2 304 tons delivered to the landfill by a group of 100 scavengers is recycled (municipal official 2, personal communication, February 25, 2021). In the municipality of Chihuahua, 4% is recycled by a group of 300 scavengers affiliated with the Regional Confederation of Mexican Workers and Farmers (Confederación

Regional de Obreros y Campesinos; CROC) (municipal official 5, personal communication, April 28, 2021).

In terms of the second aspect, which pertains to the willingness of actors from different sectors to participate in public management for implementing the circular economy, it can be affirmed that there is a mature understanding of the technology, information management, and communication needed to undertake projects related to the circular economy model, particularly in municipalities considered urban and metropolitan. Representatives of maquiladora companies (Index-Juárez and Chihuahua) exhibit the greatest openness to establishing programs and projects led by authorities, aiming to apply, at the very least, the models of material reduction, recycling, and reuse (the 'three Rs' model).

Likewise, actors from other sectors, such as academia, organized civil society, and citizens, find themselves in a similar situation. They acknowledge that the legal path is the route to creating consensus and materializing initiatives that involve all actors in a shared responsibility scheme. Through this research, it was revealed that civil society, in general, can be placed on an equal footing with government and business actors to jointly implement efficient public management of the circular economy.

The exercises for the proper management of MSW and SMW studied are linked to the direct involvement of social actors located in schools, private companies, commercial chains, neighborhood and subdivision committees. Notably, the Integral Waste Management Group of Juárez (Grupo de Manejo Integral de Residuos de Juárez), formed to address the problem of discarded tires in the city, serves as an example of the mobilization capacity that non-governmental actors have in keeping certain territories clean.

Concerning the third aspect, it becomes evident throughout this exploration that the state authority and most municipal authorities are anticipating better conditions to advance further in their initiatives. Although several procedures can be adjusted through a legal framework, facilitated by the incorporation of the new General Law on Circular Economy (currently in the approval process) into the existing legal structure, institutions must fortify themselves with specialized bodies in the field of comprehensive management of MSW and SMW. For instance, during discussions about the feasibility of establishing a state center specialized in waste management, operating autonomously from the Ministry of Urban Development and Ecology (Secretaría de Desarrollo Urbano y Ecología [SEDUE]) of the state government, participants in the VPWs recognized such institutional frameworks as beneficial. Consequently, there is a discernible need to enhance the state's role in this matter, enabling it, as a regulatory and mediating leader, to facilitate the interactions essential within the framework of modern governance.

Finally, it is essential to note that in the country, especially in the state of Chihuahua, there exist legal, institutional, and economic conditions conducive to advocating for the active involvement of social actors within the governance framework designed for the circular economy. However, the participation of non-state actors has not been adequately valued or harnessed, resulting in a slower progress compared to other countries that have effectively addressed this issue. Regarding

participation, there is a unique opportunity to formulate a national initiative for social persuasion, aiming to discourage the consumption of products that generate high entropy. This, in turn, can foster the establishment of official standards promoting innovative packaging designs, maximizing material utilization, and seamlessly integrating both matter and energy into ecosystems.

Translation: Erika Morales.

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