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From Waste to Value: The Economic Impact of Circular Economy Practices on SDG Achievement in Spain's Tire Industry

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Abstract

This study explores the intersection of circular economy practices and sustainable development within the framework of stakeholder theory, emphasizing the strategic importance of waste valorization for achieving long-term socio-economic objectives. Focusing on the case of used tires in Spain, the research evaluates how public and private sector actors contribute to the implementation of circular economy policies and their alignment with the United Nations Sustainable Development Goals (SDGs). Drawing on recent developments in industrial ecology and sustainable waste management, the paper analyzes the value generated through tire recycling initiatives, considering both environmental outcomes and economic returns. The role of stakeholder collaboration—across government bodies, manufacturers, and recycling firms—is critically examined to assess how these efforts collectively impact specific SDGs. Findings indicate significant progress in areas such as responsible consumption, climate action, and innovation, while also identifying gaps in regulatory coordination and infrastructure. This case demonstrates how the circular economy can serve as a catalyst for sustainable industrial transformation and provides insights for policymakers and industry leaders aiming to integrate sustainability into economic planning.

Keywords: Circular Economy, Sustainable Development Goals (SDGs), Waste Management, Tire Recycling, Stakeholder Engagement, Spain, Industrial Ecology

Introduction

Literature Review

The relationship between mankind's actions and the environment in which we live (considering environmental aspects as well as social ones) has been the basis of multiple theories. In the case of organizations, not simply a one-person action, stakeholder theory constructs a solid baseline to understand the existing links between a company's actions and the socio-economic environment in which they operate. Taking as a standing point John Locke's philosophy, Donaldson (1982) evidenced that a company's nature is to create value for society and impact it in a positive way, aspects that go beyond finance and income generation (Donaldson and Dunfee, 1999, Freeman, 1984; McWilliams and Siegel, 2001), and the equivalent approaches of stakeholder theory (strategic corporate social responsibility, enlightened self-interest, to name a few).

Although there are several definitions that emphasize diverse aspects, in general terms, the link between companies and business can be described in two main aspects: the legal requirements (including local regulations as well as international ones) and the voluntary actions that the organization carries out beyond legal obligations. The combination of both is known as the social responsibility of a business, also called Corporate Social Responsibility (CSR). This can also be transferred to other type of organizations not only for-profit, as it is understood that all types of organizations operating in social contexts must honor the social contract.

In this context, the responsibilities organizations have towards the community and the environment must consider all aspects, and the long-term impact of their operations (Porter and Kramer, 2002). Because of this, stakeholder theory considers that when organizations understand and take this premise as the baseline for their operations, society will value them higher and will continue to support their operations. Hence, there is no tradeoff between CSR and business strategy (McGuire et al, 1988; Shepard et al, 1997; Quazi and O' Brien, 2000; Jones et al, 2007; among others).

According to the Brundtland Report (1989) there is a worldwide consensus with regards to the importance of achieving sustainable development. In this report, the concept of sustainable development is defined as a socioeconomic model through which present needs are satisfied while allowing for future generations need's satisfaction. In this context where there is a shift in the common paradigm towards the socio-economic context in which firms operate, the United Nations created the Global Compact, in which firms adhere and commit to 10 principles related with the reduction of environmental impact, further respect for human rights and labor rights, and a constant fight against corruption. With this, there were regional and local governments that also adhered to the initiative, considering the alignment with these principles was in favor of the overall community they were representing. In addition,

the UN further enhanced the commitment by determining 17 specific goals for a global sustainable development to deter the current impact of human behavior, Figure 1 summarizes those goals commonly referred to as Sustainable Development Goals (SDGs).

Figure 1: Seventeen SDGs. **Source**: UN (2018)

Based on the Brundtland Report, and the first two decades following the increased importance given to it, Redclift (2015) examines the conceptual history and argues that there are many ways in which to interpret sustainability. It has been evidenced that the commitment with the issues of global environmental justice have been addressed through multiple initiatives, combining a reduction of productive processes' impact with a transformation of those activities into positive impact.

Along these lines, in terms of improving the acitons carried out towards reducing the environmental impact, in Europe the European Union members have agreed to several regulations from 1975 up to date, with the first one being 75/442CE, followed by 91/156CE to create a framework for waste management. Each country has later on adapted those regulations and incorporated them, such as is the case of Spain with the Waste law (Ley 10/1998) which focuses the responsibility of proper waste management on producers. Seven years later, the Royal Decree 1619/2005 consolidates waste management and the specific case of used tires which can have multiple approaches and can have a complex managemeny, yet the impact in the framework of a circular economy is significantly high. In addition, in 2011 the Spanish

government created a new regulation aimed at improving management of waste and reduction of contaminated soil, including in the specific case herein mentioned:

Prevention of non-managed used tires.

Creating a legal framework for the production and management of tires, as well as promoting the reduction, reuse and recycling, together with other measures that can re-value the used products and protect the environmental impact.

Define and regulate the activities and responsibilities of each of the actors intervening in the management of used tires (producers, waste managers, recycling entities, among others).

Some of the iniciatives incude the collective producers' responsibility (called SCRAP on behalf of the acronym in Spanish), which enable a detailed tracking of the products' trail in the market, from its production, to the selling point, to the collection point, etc. In addition, there is a specific tracking system of not only the producers' responsibility, but also the overall treatment, in the particular case of tires, of the treatment of used tires (TNU according to the Spanish acronym). Currently, there is a 70% of tires covered under SCRAP, where producers take direct responsibility of the management and lifecycle of tires, while the remaining 30% is managed through TNU.

SCARP is based on the obligation firms producing tires have towards declaring the number of tires they sell in the market (whether they have been produced within Spain or are imported and sold inside the national market). Additionally, it charges a "green fee" when consumers purchase a new tire and it is responsible for managing used tire pick up trails in order to manage those wastes, through one of the main three ways in which the Spanish Law introduced in 2011 considers:

Re-usage: operations through which products or components of those products can be used a second, third or further times with the same utility.

Extracting value: transformations that result in turning waste into valuable elements that can serve as an input in the same productive process (substituting raw material extraction, or or other intermediate input), or converting the otherwise waste into an element valuable for the economy in general terms. Includes energetic value, for instance used tires can be burned in order to create heat and through this process produce energy.

Recycling: process through which the waste is transformed into a full product, material or substance, whether it meets the original product's cycle of production or it is inserted into a new economic area. This includes the transformation of organic matter yet not the energetic production, which would be included in element b.

Hence, there is a theoretical circular procedure through which all tires that are introduced to the market will be eventually reused, valued or recycled, as all producers are obliged to participate in this process or include a "green fee" surcharge

(disclosed in the invoice provided to the final consumer) which will be destined to the used tires management process. However, it is unclear the impact of the current status this particular aspect of the circular economy in relation with the achievements of the SDG. This paper proposes a comprehensive approach towards analyzing the impact of legal regulations, the combinations of private and public entities, together with how each aspect of the circular economy impacts the achievement of SDGs. Results show there is a strong link, showing a proper implementation of the principles underlying the circular economy can significantly contribute to fulfilling SDGs. This will be our contribution.

Methodology and data collection

Firstly, the overall tire market is evaluated in order to establish a framework that defines the circular economy in this particular sector, including specific data regarding the number of used tires that are processed through the SIG.

Figure 2 depicts the processes and Table 1 summarizes the data of the Spanish Tire Market in 2016, divided by each management.

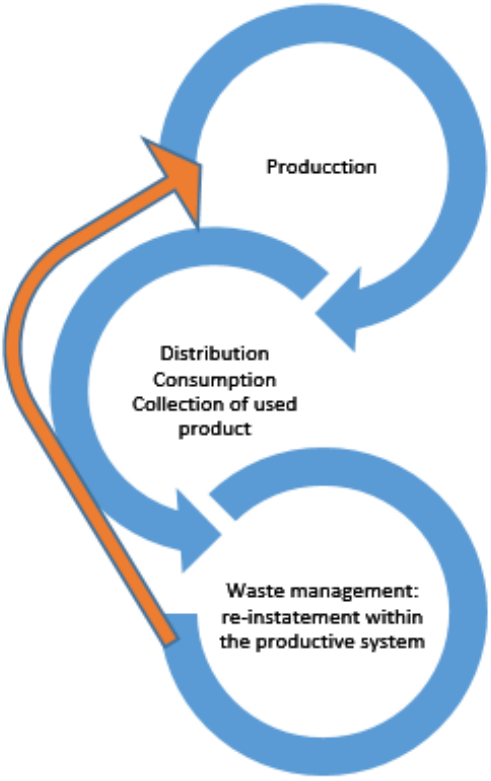

Figure 2: Circular flow of the tire productive system, **Source**: Author compiled

Spanish Tire Market		2016		
		Integrated system for Used Tires	Treatment of Used Tires	TOTAL
Number of companies		313	107	420
Number of tires sold in the national market	Declared (Tons)	170171	66.223,73	236.394,73
	Expoprts	8643	196,97	8.839,97
	PEM neta Tn	161529	66.026,77	227.555,77
Number of points where tires were generated		25.677	5.635	31.312,00
Used tires collected	Tons collected	189.259	68.295,85	257.554,85
Destination of used tires	Re-usage	12%	13,51%	13%
	Extracting value (materials)	54%	40,02%	50%
	Extracting value (generation of energy)	36%	46,67%	39%

Table 1: Summary of tires introduced to the market and collection of used tires. **Source**: Author compiled based on TNU (2016) and SIGNUS (2016)

As it can be evidenced, plans to increase the product lifecycle of tires, improve the easiness with which the item can be reused, improving the recycling and other ways in which value can be extracted from used tires, together with the reduction of the ecological footprint are at the core of the Spanish Tire Market in order to meet the circular economy's expectations. To further expand the analysis, the second step was to link the evidenced results of the current productive framework and evaluate if and to what degree each of the SDGs are being impacted, taking into account those objectives that have a higher correlation with waste management (objectives 1-5, 10 and 13 were considered to have an indirect impact hence they were not deemed to be the core aim of this study).

Results and Discussion

Stakeholder theory is based on the social contract and all members of society, individuals and organizations alike, respecting one another, minimizing any negative impact imposed on fellow members through their individual or collective actions. This, together with an idela of sustainable development, comprises the framework in which the circular economy provides a solution to better manage resources and wellbeing, together with the definition of principles (UN Global Compact) and Goals (SDGs) that summarize the areas in which society should collectively take action.

In this paper the Spanish used tire market is analyzed, and the impact it currently has on the achievement of SDGs, to evaluate the practical impact of the circular economy to this end. Furthermore, the evaluation focused on tangible impacts that are nowadays used, as well as potential impact of future discoveries through the strong R&D efforts that are currently being carried out. Table 2 summarizes the findings, with a comprehensive detail on the impact the used tire system causes in each of the SDGs according to the circular economy's phases. It can be evidenced that in some cases, more than one SDG is positively impacted by this waste management system, and in more than one phase.

This significantly contributes to the creation of a solid framework to promote not only sustainability but also the improvement of economic foundations through a circular and not a linear operating system. Additionally, the experiences from multiple states within the European Union can create a context in which the collaboration and shared-learning can contribute to an overall improvement of the social and economic impact of the tire production and the overall industry. What is more, this context enhances the principles of stakeholder theory, as firms participating in this environment, whether they are direct producers of tires, they supply raw materials, they collect used tires, etc., they are honouring the social contract.

The impact of this within stakeholder theory is twofold: on the one hand, there is a clear and specific action abiding the Spanish law and minimizing environmental impact, on the other hand, they are contributing to the creation of a new economic order in which they are creating value, obtaining a solid economic profit, while taking a hands-on approach to solve socio-economic issues. The combination of both, as evidenced by scholars in the field, proves once again there is no trade-off between CSR and profit, it depends on the strategies implemented and the context in which a firm operates (i.e. the value assigned to each of the initiatives).

SDG	Circular economy's impact on SDG	Solution provided by Tire system
6: Clean water and sanitation 14: Life below water	Waste management: recycling	Avoids tires being disposed in natural areas, particularly rivers, creeks or other hydraulic resources, which contributes to safer and cleaner water for human consumption as well as not damaging life below water's ecosystem.
7: Affordable and clean energy	Production phase Waste management: reusing Waste management: extracting value	Through the prevention and selection of processes Products being fully or partly reused reduce the energy consumption By burning the tires and extracting energy from the heat
8: Decent work and economic growth (specifically 8.2 and 8.4)	Production phase Waste management: reusing Waste management: recycling	Prevention plans promoted through the recent Laws result in higher durability in products together with greater options for recycling, resulting in lower raw materials and ecologic footprint, contirbuting to economic growth Less need for raw materials extraction, constant R&D processes to discover new markets, usage of raw materials and products. The creation of recycling-related jobs contributes to decent work and economic growth

9: Industry, innovation and infrastructure	Production phase Waste management: recycling	Prevention plans and R&D translate into input, energy and production process savings, with outputs that are more reusable, reciclable and sustainable There are many usages that can be derived from recycling used tires, such as concrete. The variety of implementations in diverse industries is wide, as well as the spillover of technology, techniques and innovation form developed nations (Spain) to developing countries, reinforcing sustainability worldwide
11: Sustainable cities and communities (specifically goal 11.6) 12: Responsible consumption and production (specifically goals 12.4 and 12.5) 15: Life on land	Production phase Distribution and consumption phase Waste management: recycling Waste management: extracting value	Through prevention and awareness raised in consumers, better products and initiatives can be created All the agents participating throughout a tire's lifecycle participate in the waste management framework either through direct or indirect actions Combinations of asphalt and tires turn cities using these inputs to create streets much more sustainable. All members of the community are involved, including collection points where any member of the community can actively be involved in proper waste disposal. This positively impact

16: Peace, justice and strong institutions (specifically goal 16.12) 17: Partnership for the goals (specifically goals 17.7, 17.14 and 17.17)	All phases (entire circular economy framework)	The European Union has been promoting joint-actions between all state members to tackle economic issues and move towards a circular economy environment instead of a linear one. Spain is specifically undertaking actions to achieve EU goals, modifying energetic consumption, type of energy used, reducing CO2 emissions, and other actions through proper tracing production and adequately managing waste. The 2030 Agenda set for Europe includes multiple objectives where the EU strengthens the institutional support and guidelines, together with partnership between member states to further advance and achieve said goals.

Table 2: Link between SDGs and the solutions provided by the Spanish used tire system in the framework of the circular economy. **Source**: Author compiled

The study provides insights on the links between circular economy and SDG specific benefits, however it is limited to the case of Spanish used tires management systems. TO further enlarge the knowledge in this area, other waste management elements, such as glass or plastic should be evaluated, as well as replicating this study in other EU countries, which follow the same overall directive and have access to partnerships. Lastly, it would be of interest for both academia and practice to study developing nations, comparing and contrasting their results with those of developed nations.

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