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FROM USELESS TO VALUED: SOCIAL ENTERPRISES IN THE TIRE RECYCLING

DE INSERVÍVEL AO PRESTADIO: NEGÓCIOS DE IMPACTO NA RECICLAGEM DE PNEUS

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Abstract

This article analyzes the economic and socio-environmental feasibility of businesses focused on collecting, treating and redirecting unusable tires within the production chain, with the metropolitan region of Belo Horizonte, Minas Gerais, Brazil, as the context. Based on Impact Businesses, which seek to add value by promoting sustainability through market ventures, interviews were conducted with representatives of these enterprises, along with the application of questionnaires. The study identified characteristics, strategies and challenges of this business niche and partnerships in the production process, enabling growth projections. Socio-environmental aspects are embedded in the business objectives, demonstrating an inverse relationship between profitability and negative socio-environmental impact.
Keywords: Impact Businesses. Social Enterprises. Recycling. Reverse Logistics. Tire Supply Chain.

Resumo

Este artigo analisa a viabilidade econômica e socioambiental de negócios orientados para coleta, tratamento e redirecionamento do pneu inservível na cadeia produtiva, tendo como contexto a região metropolitana de Belo Horizonte/MG. Com fundamentação em Negócios de Impacto, que procuram agregação de valor promovendo a sustentabilidade através de empreendimentos de mercado, foram realizadas entrevistas com representantes desses empreendimentos e aplicação de questionários. Verificaram-se características, estratégias e desafios deste nicho de negócios e parcerias no processo produtivo, possibilitando projeções de crescimento. Quesitos socioambientais estão nos objetivos do negócio, demonstrando existência de relação inversamente proporcional entre lucratividade e impacto socioambiental negativo.
Palavras-chave: Negócios de Impacto. Negócios Sociais. Reciclagem. Logística Reversa. Cadeia de Pneus.

Introduction

The Brazilian economy presents an entrepreneurial support ecosystem that aims to foster the creation of new businesses. In light of digital transformation, economic volatility, complexity, and uncertainty, it becomes necessary to adapt strategies, develop new business models, and design differentiated structures to face current challenges (Calado & Souza, 2024), as well as to improve contextual analysis and the understanding of the relationship between existing conditions and resulting outcomes (Lira et al., 2024).

One type of new enterprise that has gained increasing prominence in the Brazilian context is known as an Impact Business. These ventures seek to create value by addressing social and environmental problems without forgoing profits or market integration through the commercialization of products and/or services (Medina Filho et al., 2024; Comini, 2016; Austin, Stevenson & Wei-Skillern, 2012; Mair, Robinson & Hockerts, 2006). The core idea is not philanthropy, but rather the development of businesses with a positive social impact – that is, enterprises that generate economic value while simultaneously delivering social and environmental value (Alperstedt, Andion & Pires, 2024; Medina Filho et al., 2024; Barki, Rodrigues & Comini, 2020; Barki, 2015; Prahalad, 2010; Yunus, 2009; Hart, 2005; Prahalad, 2005; Prahalad & Hart, 2002).

Based on data from Brazilian Institute of Geography and Statistics (IBGE, 2019), the Belo Horizonte Metropolitan Area [BHMA] stands out as an important industrial hub in Brazil. According to a survey conducted by the Minas Gerais State Development Bank [BDMG], cities such as Belo Horizonte, Betim, and Contagem exhibit high levels of logistical accessibility within the state, making the region a strategic point for the distribution and circulation of goods, as reported by the Logistics Superintendency of the State Secretariat for Economic Development of Minas Gerais (SULOG, 2024).

Given the industrial base of the regional economy, it is possible to identify a production system focused on industrial activities. However, there is a noticeable lack of businesses that, in addition to seeking profits, are also committed to solving contemporary social and environmental issues and addressing the impacts – direct or indirect – caused by their activities (Comini, 2016; Yunus, 2008). In Brazil, the presence of initiatives within the category of Impact Businesses remains limited, despite the country being regarded as one of the nations with the greatest potential for environmental and social innovation (Yunus, 2017; Barki et al., 2015).

Given that impact businesses have the potential to produce positive outcomes in various areas – such as job creation, social inclusion, improved quality of life, and environmental preservation – it is necessary to develop thoughtful responses to social inequalities and the degradation of natural resources (Medina Filho et al., 2024). Accordingly, this study focuses on analyzing businesses located in the Belo Horizonte Metropolitan Area that specialize in the collection, processing, and reuse of discarded tires as raw materials for the development of new products. Businesses with such characteristics can be considered Impact Businesses, as they seek alternative uses for end-of-life tires (Phillips et al., 2015). This type of activity prevents post-consumer tires from ending up in landfills, which can become breeding grounds for the Aedes aegypti mosquito, a vector of diseases such as *dengue*, *chikungunya*, and *zika* (Jung et al., 2017). One of the key features of this type of business is its focus on generating collective rather than merely individual benefits (Barki, Rodrigues & Comini, 2020; Brandão; Cruz & Arida, 2013).

In the case of tires, approximately 53 million units are manufactured annually in Brazil, which corresponds to roughly 729 thousand tons of new products every year, according to the National Environmental Council [CONAMA] (Conama, 2017). Tires are among the primary products to be included in reverse logistics systems, as they pose significant environmental hazards when improperly disposed of (Andrade, Moreira, Silva Bernardo & Ravena, 2020; Abramovay et al., 2013).

Considering the principles underlying businesses that aim to solve social and environmental problems (Yunus, Moingeon & Lehmann-Ortega, 2009), the objective of this research is to analyze the main factors, operational features, and challenges present in this business niche. In addition, the study examines the direct and indirect social and environmental impacts that arise from market activities linked to the recycling of unusable tires, as described by Brandão, Cruz and Arida (2013).

This article is structured as follows: the next section presents the conceptual framework that guided the research, followed by methodological procedures, which involved both qualitative and quantitative data, and the analysis of the market potential for creating Impact Businesses in the field of tire recycling in the Belo Horizonte Metropolitan Area. Subsequently, the paper explores the possibilities, challenges, and dynamics involved in designing new ventures aimed at generating economic, social, and environmental value in the tire recycling sector – a socio-environmental context marked by significant risks and problems, but also by important opportunities for the creation of Impact Businesses.

Impact businesses: between the economic, the social, and the environmental

In recent decades, so-called Impact Businesses have sparked debates about the possibilities of promoting new market dynamics oriented toward sustainability (Barki, Comini, Cunliffe, Hart & Rai, 2015; Barki, 2014; Hart, 2005). A series of studies, promoted by different research centers and led by relevant scholars in the field of Business Administration – whether based in central countries or in peripheral ones – have focused on analyzing the nature of these businesses, their objectives, their impacts on social, economic, environmental, political, and cultural issues affecting communities and countries, and their relations with traditional businesses, governments, and civil society and community organizations (Romani-Dias et al., 2017; Mswaka & Aluko, 2015; Iizuka et al., 2014; Defourny & Nyssens, 2012). Research on Social Impact Businesses has been advancing in recent years (Barki et al., 2020; Gupta et al., 2020), reinforcing innovation in the economy, especially in addressing social challenges (Gifford, Mckelvey & Saemundsson, 2020). In this field, the aim is to find viable solutions to social and environmental problems through collaboration and beneficial partnership networks (Carayannis et al., 2021; Dias & Correia, 2024).

Different terminologies are found to characterize Impact Businesses (Alperstedt, Andion & Pires, 2024; Ranville & Barros, 2022; França Filho et al., 2020; Barki et al., 2020; Defourny & Nyssens, 2010; Defourny & Nyssens, 2007). Part of the literature prefers to use the term Social Enterprises (Alperstedt, Andio & Pires, 2024; Defourny & Borzaga, 2001), while terms such as Social Businesses, Inclusive Businesses, Base of the Pyramid Businesses, and B-Type Companies (Benefit Corporations) (Abramovay, 2012) also appear in the international discussion to characterize ventures that are not solely oriented toward their owners and profit generation, employment and income creation, and tax payments, but also aim to generate value for different stakeholders, supporting the resolution of social and environmental problems that afflict societies, communities, social groups, and multiple segments experiencing poverty, stigma, precarious living and health conditions, and the inability to realize their potential, among other contemporary issues (Austin, Stevenson & Wei-Skillern, 2012). These elements form a field of divergence where it is not uncommon to find contradictions and ambiguities in the arguments across studies and contexts (Ranville & Barros, 2022).

Within the studies on Impact Businesses, there are relevant debates (Besley & Ghatak, 2017), in which some authors analyze the nature of these ventures, often highlighting their hybrid characteristics due to the articulation of various institutional logics (market, bureaucratic/state, and sociopolitical rationalities) (Mswaka & Aluko, 2014; Brandão, Cruz & Arida, 2013). In this debate on the nature of Impact Businesses, part of the literature takes a normative approach, defending different organizational models – some more market-oriented, others more community- and environment-focused (Comini, Barki & Aguiar, 2013). In peripheral countries, a significant portion of this literature is dedicated to discussing the relationship between Impact Businesses and community leaders, which may sometimes assume a self-managed, cooperative, and communitarian character, while in other cases, communities

are subjected to the mere adoption of policies, strategies, technologies, and actions designed by technical experts and managers of these ventures aimed at producing positive economic, social, and environmental impacts (Alperstedt, Andion & Pires, 2024; Defourny & Nyssens, 2017).

Brazil can be considered an important context for analyzing Impact Businesses, not only due to the vastness of its territory and the diversity of its economic and cultural vocations, but also because of the nature of its social, political, cultural, environmental, and economic challenges (Comini, 2016; Petrini, Scherer & Back, 2016). Additionally, some cases regarded as exemplary Impact Businesses are found in Brazil, drawing the interest of research centers and scholars from different parts of the world (Comini, Barki & Aguiar, 2013).

Regarding the promotion of sustainability (Machado & Matos, 2020), the diffusion of environmental management practices among large, medium, and small enterprises (Lima, Costa & Pereira, 2020), and specifically the management of solid waste – which includes the consumption and post-consumption (disposal) of tires – the Brazilian context presents itself as a highly relevant locus for investigation. As in other economies around the world – such as India, South Africa, and several Latin American countries – the collection of recyclable materials and the reverse logistics chain are marked by the presence of workers living in poverty and precarious employment conditions, organized into waste picker cooperatives that attempt to mitigate productive exclusion, fragile working conditions, and ensure their place in increasingly modernized reverse logistics chains (Jesus & Barbieri, 2013). The National Solid Waste Policy (PNRS), with governance regulations that impose new obligations on companies producing goods and packaging, also secures space for cooperative ventures led by waste pickers (Besen et al., 2014; Abramovay et al., 2013). It is worth noting that, depending on the literature and approach adopted, waste picker cooperatives can be considered Impact Businesses (Campos et al., 2009).

Another relevant advancement in the Brazilian context – despite the persistence of challenges between the emergence of new laws and the effective guarantee of workers' rights in collection and recycling – is the formal recognition of waste picking and recycling activities in the Brazilian Occupational Classification (COB), extending labor rights to a group that for decades has been the target of stigma and prejudice and subjected to precarious working conditions: recyclable material waste pickers (Baptista, 2015; Pereira; Godoi & Coelho, 2012; Bourahli; Kondo; Hedler & Batista, 2011; Gonçalves-Dias, 2002).

In this context, it is crucial to analyze the potential for the emergence of Impact Businesses in the tire collection and recycling activity – a field of research that carries rich possibilities for understanding the opportunities and risks of creating new ventures that aim not only to generate economic activity but also to create social and environmental value for the workers involved and for society as a whole. This demands special care in defining the methodological procedures of the investigation.

Methodological procedures

The investigation is situated within the field of qualitative research, although it draws upon both qualitative and quantitative data to analyze the opportunities and risks for Impact Businesses engaged in tire recycling in the Belo Horizonte Metropolitan Area (BHMA). As Minayo (1993) asserts, the relationship between quantitative and qualitative approaches should not be understood as a contradictory opposition. Ideally, social relations must be analyzed in their most concrete aspects and deepened in their most essential meanings. Authors such as Lakatos (2003) corroborate this understanding in their treatment of data analysis and scientific methodological grounding, which in this study was based on the case study method (Eisenhardt, 1989).

Firstly, based on Lakatos (2003) and Aaker (2001), the data collection strategy was conducted through eight semi-structured interviews and the simultaneous application of questionnaires (purely aimed at

building a general overview with descriptive statistics) with representatives of companies that carry out activities with the aforementioned characteristics, located in the metropolitan region of Belo Horizonte, as well as representatives of reference companies in Brazil, partner entities, and field specialists. The local companies were selected based on the prominence of their activities in the region. The purpose was to identify the strategies used for tire collection – that is, how to gather them to be reprocessed – as well as to recognize those responsible for ensuring that these tires are properly collected and transported for their new purpose. In summary, this stage aimed to assist in understanding how reverse logistics works – if it indeed occurs – as well as the final destination of these already unusable products.

Secondary data analysis was essential for identifying the primary destination of treated tires, seeking to determine, within the BHMA and nearby regions, what products or services are currently in market demand. The goal was to analyze already published data to support the identification of trends, the establishment of benchmarks, and the mapping of more targeted niches in which business operations could be developed. There is a vast and "impressive" array of products that can be developed from recycled tires, ranging from fuels to footwear. Tires may reappear as part of the roads we drive on, or even as the bricks in our homes, as emphasized by the National Environmental Council (Conama, 2017). Given this wide variety of applications, secondary research proved vital in identifying strategies with greater accuracy.

Regarding reverse logistics, it was possible to assess the situations of each company using the concepts of Leite (2003), in comparison with those presented by Lacerda (2002). Additionally, the National Solid Waste Policy (2010) contributed to the analysis concerning the set of actions, procedures, and mechanisms aimed at enabling the collection and return of solid waste to the business sector, for reuse either within the same production cycle or in other productive cycles, or for environmentally appropriate final disposal.

At the conclusion of the study, an evaluation of the potential social and environmental impacts generated by the business was carried out through the method of Thematic Analysis (Braun & Clarke, 2006). The discussion by Brandão, Cruz, and Arida (2013) was instrumental in analyzing changes occurring in a community, population, or territory through a causal relationship between those changes and business activity. Furthermore, the literature on Impact Businesses served as a key reference throughout the analysis, allowing for the combination of business and socio-environmental aspects – such as the periodic monitoring of disease indicators linked to improper tire disposal (*dengue*, *chikungunya*, and *zika*) and the verification of quality-of-life improvements, particularly in communities experiencing vulnerability.

The market research, conducted in accordance with the principles outlined by Churchill (2003), was based on the analysis of four companies engaged in activities similar to market practices involving the collection, processing, and redirection of end-of-life tires. These companies may be considered potential support points in this process, although they present distinct characteristics, focuses, and strategies, which enriched the research with greater detail and depth. To preserve the confidentiality of these companies, they were identified as X1, X2, X3, and X4. The same confidentiality was applied to the support approaches, which involved consultations with nationally recognized organizations (R1), partner entities (P1), and field specialists (E1):

Table 1

Summary Framework of the Research Approach

ID	Main Characteristics	Reference	Interviewees
X1	Tire and metal scrap recycling; owns fleet for collection; processing capacity of 2,500 tons/month of tires and 1,600 tons/month of metal scrap; environmental certification. Operates in Betim, with a focus on the entire Metropolitan Region of Belo Horizonte (MRBH).	Local market reference	1
X2	One of the largest companies in the sector; collects a wide variety of tires (cars, motorcycles, airplanes, tractors, trucks, etc.); specialized separation and shredding; own logistics. Operates in the MRBH and also in various regions of Brazil.	Local market reference	1
X3	Operations focused on rubber derivatives; high technology and Italian equipment; sells to companies that use tires in their production process; various logistics partnerships. Operates in the MRBH.	Local market reference	1
X4	Minas Gerais-based company; focus on vulcanized rubber from end-of-life tires; local operations. Headquarters in Pará de Minas, but strong presence in the MRBH.	Local market reference	1
R1	Brazilian company that competitively and creatively manufactures sustainable shoes and accessories using recycled tires as the main raw material.	National market reference	1
P1	Managing entity with governance involving tire manufacturers in Brazil, aimed at coordinating the collection and environmentally appropriate disposal of end-of-life tires. Acts as the main reference in reverse logistics in the sector.	Partner entity	1
E1	Specialist in social management and impact businesses working at Brazilian University	Specialist	1

Tire recycling market in the Belo Horizonte Metropolitan Area (BHMA)

Firstly, it is important to highlight that, according to the National Environmental Council (Conama, 2017), companies that work with the processing of unusable tires focus on three types of materials: nylon, rubber, and metal scrap. Of these, the latter two are the most commercialized and reused by other market segments and are therefore more in demand.

Beginning the analysis with company X1, located in the city of Betim, in Greater Belo Horizonte, its operations are centered on the collection, processing, and redirection of products derived from rubber

and metal scrap extracted from unusable tires for the footwear, construction, and steel industries, which constitute its main market focus. Its monthly logistical capacity allows for the handling and processing of 2,500 tons of unusable tires and 1,600 tons of metal scrap, according to information provided by the company.

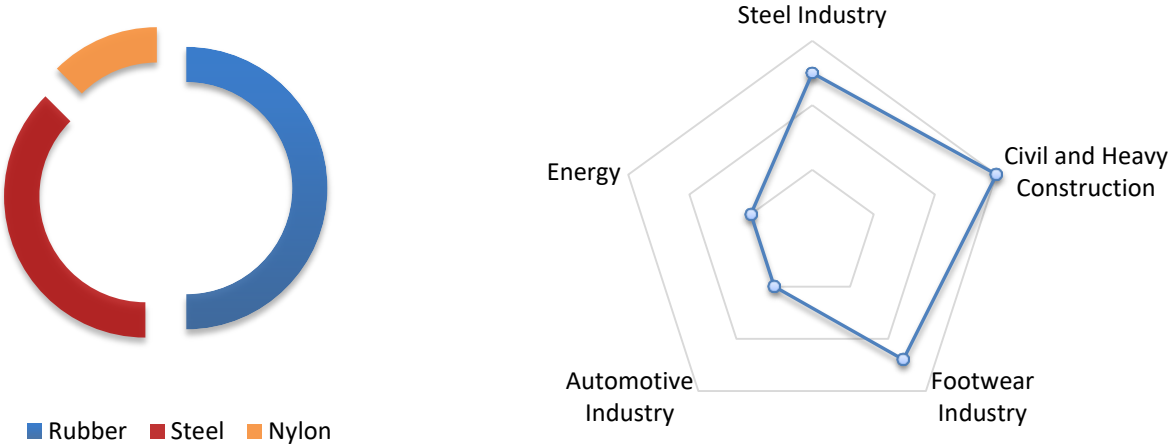
Company X2, one of the leading firms in this sector in Brazil, is headquartered in São Bernardo do Campo/SP and operates branches in the state of Minas Gerais. Its production and commercial processes are focused on the transformation and sale of rubber and metal scrap from tires to the steel and construction industries. In 2013, according to historical production data provided by company X2 itself, approximately 140,000 tons of waste (unusable tires, rubber scraps, and steel) were processed, removed from nature, and disposed of in an environmentally appropriate manner.

Headquartered in Guarulhos/SP since its foundation in 2002, and with a branch in Minas Gerais, company X3 operates in the collection, shredding, recycling, and environmentally sound disposal of rubber and tire waste. It employs advanced technology in its production process, which is entirely focused on rubber-derived products. Its main competitive advantage, as described by Hitt (2003), lies in its differentiation strategy: it markets its products to companies that use tire-derived material exclusively in their production processes, such as firms that manufacture ecological bricks, biomass compounds, benches, and mantars (used for absorbing impact and sound in floors and/or walls, and applicable between slabs, under laminated flooring, partitions, and other locations).

Company X4 is a Minas Gerais-based firm located in Pará de Minas, a city within the Metropolitan Mesoregion of Belo Horizonte. It focuses on obtaining vulcanized rubber from unusable tires. Unlike the other companies, X4 concentrates on a single product, thus differentiating its strategy with a limited portfolio (Porter, 1996). However, a strategic factor lies in the demand for vulcanized rubber by the tire manufacturing companies themselves, appearing at two points in the product cycle: in the collection of used tires and in the supply of rubber for tire manufacturing. This, as emphasized by the Brazilian Association of Retreaded Tire Industries [ABID] (Abid, 2016), demonstrates a significant competitive advantage achieved through differentiation (Porter, 1989). Based on the data collected from the four companies, it is possible to identify the main products, and market demands present in the context of the BHMA:

Graph 1

Main Products, Market Demands, and Sectors

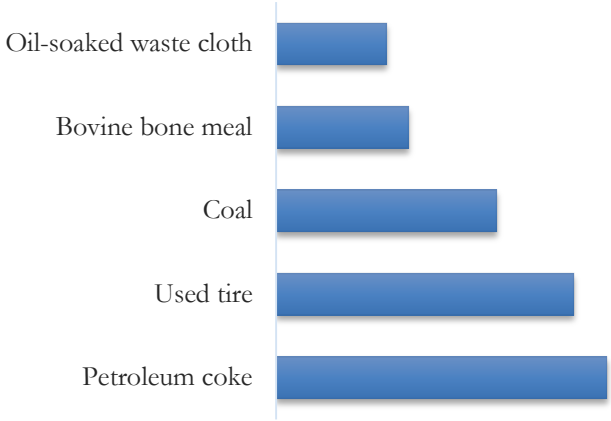


With the products and main destinations identified, it becomes valid to take "a somewhat deeper dive" into the context of their applicability. Regarding rubber, there are several strategic characteristics that

differentiate the product from similar ones on the market, potentially making it an important ally in the process of substitute products, as conceptualized by Churchill (2003). Based on data obtained in the research on the main destinations, initially focusing on its "role" as fuel in industrial processes within cement companies, Reciclanip – considered one of the major promoters of tire recycling – emphasizes the importance of the material in this application, particularly in terms of heat generation, efficiency, and costs when compared to other products:

Graph 2

Net heat generated by combustion sources, in million BTU per ton



The footwear industry, especially since 2004, has played a significant role in the utilization of end-of-life tires, using them in the manufacture of sandals, shoe soles, and other artifacts. According to information provided by R1 – a pioneering company in the production of footwear made from end-of-life tires – since 2004, the footwear industry alone has removed approximately 2.5 million tires from the environment, adding value to the production of various products. Representatives of the company stated that the process was so efficient that it was later incorporated into the manufacture of other products such as backpacks, bags, and briefcases.

The use of rubber granules in heavy construction/civil engineering involves various creative solutions applied in diverse ways, including ecological bricks, paving, shock absorbers for synthetic grass soccer fields, athletics tracks, gym flooring, construction elements in parks and playgrounds, breakwaters, traffic barriers, and even artificial reefs for fish farming, demonstrating its productive efficiency and applicability (Slack et al., 1997).

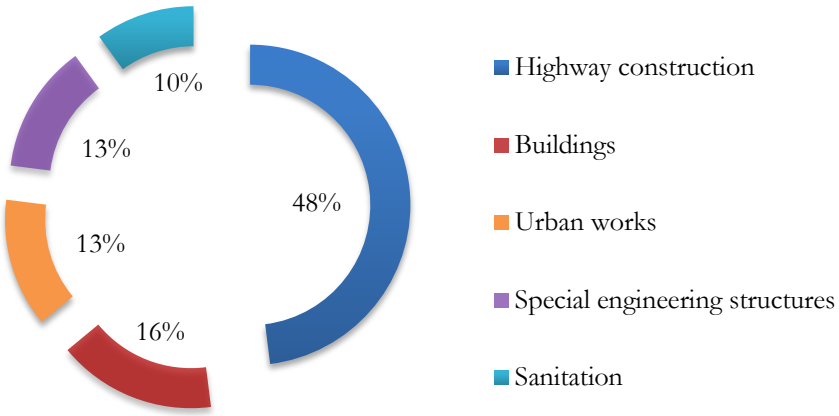
Focusing on the paving process, the use of treated rubber mixed with asphalt is a technique increasingly employed throughout the country, according to Reciclanip (2019). Known as "rubberized asphalt," the process significantly increases resistance to aging compared to conventional mixtures, where ultraviolet rays have a strong negative effect on degradation, as emphasized by Neves Filho (2004). Furthermore, the Public Prosecutor's Office of Minas Gerais (MPMG) obtained a court injunction requiring the Department of Roads of Minas Gerais (DER-MG) to preferentially use asphalt mixes produced with rubber from end-of-life tires in the construction and repair of public roads, which further highlights the material's importance.

The Heavy Construction Industry Union of Minas Gerais (SICEPOT, 2016) emphasizes that heavy construction primarily comprises companies whose main activity is roadworks. According to the union, this segment accounts for almost half of the construction companies surveyed in the state, with a 48%

share.

Graph 3

Business segment

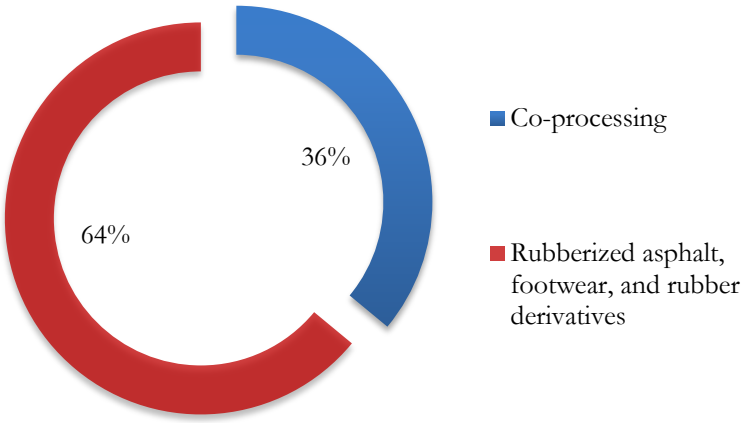


Source: Elaborated by the authors based on data from CEMPRE (2019)

Supporting the data collected in the research, the report by the non-profit organization *Compromisso Empresarial para a Reciclagem* (CEMPRE, 2015) emphasized that the most common applications of end-of-life tires are as alternative fuel for the cement industry (co-processing), automotive mats, hoses, shoe soles, rubberized asphalt, sports courts, industrial flooring, among others.

Graph 4

Destinations Process/Product



Source: Elaborated by the authors based on data from CEMPRE (2019)

One of the factors contributing to the viability of this type of service is the "secured" demand ensured by laws that regulate compliance with environmental practices involving the integration of tires into the production chain, either as whole tires or as raw materials, as highlighted by CEMPRE (2015), which cites regulations established by Law 12,305, instituting the National Solid Waste Policy (2010). In other words, companies that effectively align their market, environmental, legal, and social practices can establish strategies that make them self-sustainable, both economically and environmentally, reinforcing their business policies, market presence, and image before clients and stakeholders, thus creating a competitive advantage over other competitors (Porter, 1989).

In the same vein, Jung et al. (2016) emphasize that the end-of-life tire recycling market represents an interesting business niche, and companies that position themselves adequately in the face of challenges, logistical strategies, public policies, and legal regulatory support may achieve considerable results, as positive returns on investments may materialize relatively quickly. Finally, it is possible to highlight this mix of products offered by the four organizations analyzed:

Table 2

Product mix offered by the organizations

Material	Product	Destination	ID
Rubber	Tire chips	Fuel in cement factories can replace gravel as concrete aggregate	X1
	Rubber granulate (mesh 10)	Synthetic sports flooring; substrate under already installed grass	X1
	Rubber powder (mesh 8)	Various industrial applications; high-quality product	X1
	Rubber powder (mesh 30)	Footwear industry, rubberized accessories for cars, fuels, asphalt paving	X2
	Rubber granulate	*Mantare* (impact absorption), laminated flooring, ecological bricks, benches, construction, biomass, footwear and auto parts industry	X3
	Rubber powder (< 0.68 mm)	Footwear, rubberized accessories, fuels, paving	X3
	Tire shavings	Rubber mats for playgrounds and gardens (thermal control, fungus, insects, slugs)	X3
	Chip 2" (pieces with steel and residues)	Fuel in cement factories replaces gravel	X3
	Vulcanized rubber	Footwear industry; tire manufacturers (Goodyear, Michelin)	X4
Metal Scrap	Pressed stamping scrap	Steel industry – can be recycled without affecting the final product	X1
	Small stamping scrap	Steel industry – recyclable without damage	X1
	Loose stamping scrap	Steel industry – recyclable	X1
	Granulated steel	Steel industries	X2
	Crushed steel	Steel industries	X2

	Raw steel (untreated)	Steel industries	X2
Nylon	Nylon	Textile industry; Footwear industry	X3

Reverse logistics of tires

Various strategies were identified regarding the logistics employed by each company; however, in all cases, these logistical processes were described as the highest cost centers within their operational structures, since it is through logistics that the raw material for production is secured. Starting with company X1, their strategy relies on a proprietary fleet that collects tires from generating companies such as retreading businesses, transport companies, vehicle rental agencies, and vehicle manufacturers. The collected tires are shredded and transformed into reusable products, with the company providing a declaration certifying that the client has properly disposed of the environmental liability generated by their business, helping them comply with the guidelines established by the National Environmental Council and ensuring adherence to legislation regarding the proper treatment of end-of-life tires.

Moving to company X2, their tire collection initiative is based on registrations made either on the company's website or in person, where details of the material to be collected are submitted. Like company X1, they use their own logistics for fulfilling these collection requests. The main contributors to the tire collection process include tire repair shops, dealerships, factories, industries, and also final consumers.

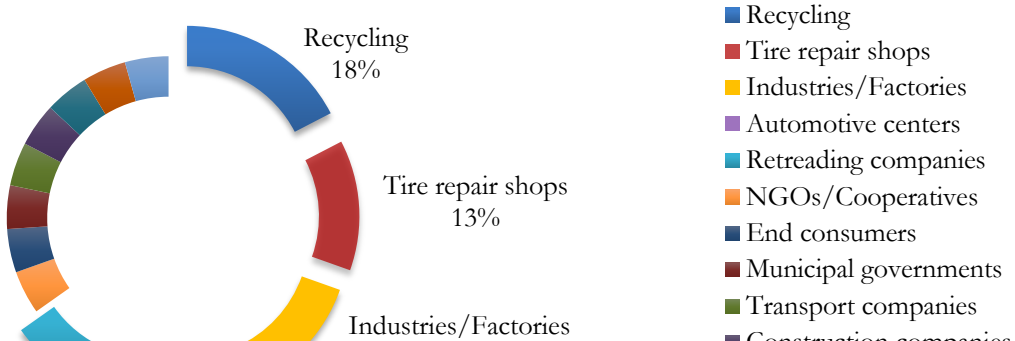
Company X3 was the only one studied to report working directly with waste pickers, waste picker cooperatives, and civil society organizations – an important factor highlighted by Noleto (2000), emphasizing intersectoral cooperation and joint actions. Furthermore, the company also collaborates with tire repair shops, automotive centers, vehicle dealerships, construction companies, factories, mining companies, municipalities, and tire retreaders.

Regarding company X4, according to its partners, logistics is one of its biggest challenges because the entire process is outsourced. During periods of high demand, investments in tire collection escalate costs, often causing budget overruns. Another notable aspect is that X4 does not engage in partnerships with companies, civil organizations, or specialized civil society organizations for this service, thus missing out on the cooperative models proposed by Schommer and Fischer (2001) and again emphasized by Noleto (2000). The primary sources of end-of-life tires, as reported by the logistics outsourcing company, are tire repair shops and small factories, but the process lacks a systematic approach.

Created by major tire manufacturers, Reciclanip is an initiative aimed at collecting end-of-life tires throughout Brazil and redirecting them to companies that incorporate tires into their production processes. All of the aforementioned companies collaborate with this initiative. According to Reciclanip (2019), the project currently maintains numerous collection points across Brazil, with 194 points in the state of Minas Gerais alone and a total of 1,053 collection points nationwide. Below, we summarize the current distribution of tire collection logistics and partnerships:

Graph 5

Collection logistics and current partnerships



As observed, various strategies can be developed to mitigate costs and make the process more efficient. However, the number of companies working with intersectoral strategic alliances (Noleto, 2000; Austin, 2001; Fischer, 2002, 2003) And Partnerships (Noleto, 2000; Tachizawa, 2002; Bava, 2002), especially with civil society organizations and cooperatives of waste pickers, remains very small. This often hinders the process on multiple fronts. Cooperation exists, but it does not encompass the full range of possible alternatives in its entirety.

It is possible to state that, in an ideal scenario where a company operating within this context is willing to carry out recycling activities using appropriate logistics and partnerships (Noleto, 2000; Tachizawa, 2002; Bava, 2002), it could collect approximately 301 tires per day, totaling around 4,270 kg/day removed from the environment in the metropolitan region of Belo Horizonte. Furthermore, combining collection strategies with government partnerships, especially at the municipal level, could reinforce and contribute to governmental recycling goals, positively and directly impacting the company's raw material supply. This would also position the company as a key reference point for individuals and businesses wishing to dispose of tires responsibly.

Beyond the market and reverse logistics

Leite (2009) emphasizes that location is a crucial factor for business success, and therefore, the decision must result from thorough research and analysis of the enterprise. Being in the wrong place can mean higher costs, low demand, and poor financial returns. In the metropolitan region of Belo Horizonte, especially in Betim, several locations fit the aforementioned characteristics, particularly areas where BR-381, Via do Contorno, and *Via Expressa* converge, which can be considered strategic points for production flow and raw material transportation (Leite, 2009). The companies previously studied carry out their activities near major state highways. However, despite indicating logistical planning in several stages, some of the studied companies have difficulty adapting processes that were initially planned without including the impact on their business stakeholders and possible intersectoral partnerships (Noleto, 2000; Austin, 2001; Fischer, 2003).

Regarding equipment, costs are considered significant, as emphasized by company representatives, since most equipment is imported and subject to exchange rate variations affecting prices or pre-established sales contracts (Gitman, 1997). Another factor, according to the National Environment Council (Conama, 2017), is that there is a wide range of products that can be manufactured, with various production procedures, processing, and treatments. Therefore, from the point of view of the companies studied, the market for used equipment is interesting, provided that origin, technical evaluations by specialists, technical documentation, and quality are analyzed.

The proposal for a business focused on the collection, treatment, and direction of unusable tires into the production chain of other products can be considered a differentiated business model, as it differs from other companies due to its purpose, intentionality, relationship with local reality, and commitment to a specific territory or community (Elkington, 1994). Many companies and entrepreneurs have seen

social needs as opportunities to develop ideas and serve new markets with solutions for relevant problems in specific communities (Medina Filho et al., 2024; França-Filho, 2020; Kanter, 1999; Mair, 2006).

In this sense, tire recycling activities seek to achieve profit, environmental, and social objectives through their processes, balancing actions to be effective in these three aspects (Elkington, 2001). There is an inverse relationship between profitability and negative socio-environmental impact, meaning that as profit increases, the negative impact of improper tire disposal decreases.

The method to maintain these aspects can be based on impact goals and business strategic planning, monitoring social indicators, and future provisions based on the current environment and where the company intends to go, aiming to solve or minimize the problem of improper tire disposal and/or storage, as emphasized by Jung (2016), based on Yunus, Moingeon, and Lehmann-Ortega (2009). Business missions and visions should align with these aspects because the efficiency of the logistics process contributes to the company's productive activities – that is, social and environmental goals are directly linked to production activities (Brandão et al.; 2013).

Indicators demonstrating the monitoring of *dengue*, *chikungunya*, and *zika* cases in the Belo Horizonte metropolitan region, correlated with monthly unusable tire collection numbers, can be considered a way to verify the connection between these logistical aspects and socio-environmental factors (Brandão et al.; 2013). According to data provided by the Belo Horizonte City Hall, around nineteen thousand tires are discarded monthly in Greater Belo Horizonte, with only a small percentage actually collected, which significantly contributes to the increase in cases of diseases transmitted by the Aedes aegypti mosquito.

Far beyond simple environmental or social causes, business practices aimed at sustainability, such as unusable tire recycling, involve a broad spectrum of factors that also consider individuals affected by the activities and threats to communities vulnerable to the harmful consequences of predatory practices (Yunus; Moingeon & Lehmann-Ortega; 2009).

The analyzed examples contribute to understanding the opportunities and challenges of Impact Businesses in the production, consumption, and post-consumption of tires in the Belo Horizonte Metropolitan Region. By combining economic business practices with solving current environmental and/or social problems, they present grand strategies capable of generating financial returns for shareholders and positive impacts directly produced by productive activities. Such enterprises can lead a new phase in waste management while opening paths for intersectoral cooperation, productive inclusion, and reduction of negative externalities.

Final remarks

In light of the results and data collected throughout this research, it was possible to confirm the market trends already identified by Conama (2017), which indicate that nylon, granules, rubber powder, and steel are the main materials demanded by the recycling market. Among these, the last three demonstrate consistent and growing demand, especially from industries such as cement, heavy construction, footwear, and steel. These materials can be integrated into different production stages (e.g., co-processing) and also into final products such as rubberized asphalt and steel components.

Beyond the relevance of tire-derived materials in industrial applications, particularly due to their calorific potential and mechanical properties, their use reflects broader innovation trends within sustainable production chains. Materials derived from tire reuse present a great competitive differential, especially rubber derivatives, those stand out for its dual value: as a technical solution and as a means to reduce environmental impact through alternative fuel generation and extended product lifespan in infrastructure. Due to its calorific power, rubber is widely used as an alternative fuel in cement kilns, besides standing out for cost reduction in production. In pavement processes, one of the main

advantages of rubberized asphalt is its increased durability and efficiency.

This environmental benefit is reinforced by legal instruments such as the National Solid Waste Policy (Law 12.305/2010), which creates favorable conditions for the emergence of impact businesses related to tire recycling. The combination of regulatory and social pressure, social, market demand and climate issues position this sector as a promising niche within the circular economy in Brazil. However, the research also highlighted the substantial operational challenges faced by companies in this sector. Reverse logistics continues to represent a critical bottleneck, especially regarding organizational complexity. Although several companies have partnerships with Reciclanip, tire repair shops and automotive centers, alliances with civil society organizations, waste picker cooperatives and local governments remain rare and, when they do exist, are precarious. Integral partnerships with these organizations and stakeholders can reduce operating costs, improve environmental outcomes, foster social impact, and align impact business with key principles of intersectoral collaboration (Noleto, 2000; Fischer, 2003; Austin, 2001). From a socio-environmental standpoint, the potential for impact is substantial. Improper tire disposal contributes directly to public health crises, particularly the spread of mosquito-borne diseases such as *dengue*, *zika*, and c*hikungunya*. In Belo Horizonte, approximately 19,000 tires are discarded every month, yet only a small fraction is effectively collected and processed - the recycling market cannot absorb all the amount discarded (if the entire metropolitan region were considered, this number would be considerably higher).

Strengthening local logistics and integrating community collection networks could significantly increase coverage and create inclusive economic opportunities (Austin, 2001; Fischer, 2003; Medina Filho et al., 2024). In addition to its environmental impact, the waste tire recycling sector has the potential to generate significant positive externalities, especially in mitigating diseases transmitted by Aedes aegypti and in including marginalized populations in the production process. However, impact businesses still perform poorly in developing collaborative networks with community entities and public institutions. It is also important to note that the sector still underutilizes strategies for community engagement and impact measurement. Although profitability and environmental performance are directly linked, most companies studied do not systematically evaluate the social returns of their operations. This weakness may be linked both to a lack of knowledge or failure to implement existing public policies, and to a lack of strategic capacity building for impact businesses to develop more effective collaborative models.

Lastly, the study has limitations. A broader territorial scope – including other regions of Minas Gerais and Brazil – could have revealed additional business models and regional variations. A fundamental question that remains unanswered is: if companies in the Belo Horizonte metropolitan region claim that logistics is their main cost, why are partnerships with civil society organizations still so rare? This limitation also points to a possible future research agenda.

In short, this study demonstrates an inversely proportional relationship between market exchanges and negative socio-environmental impacts: the greater the efficiency of exchanges, the smaller the negative impacts of improper tire disposal on the environment and society. In this line of positive impact, it is expected that this discussion inspires new research agendas on phenomena related to sustainability and recycling, such as impact businesses, partnerships, circular economy, regenerative economy, recycling of post-consumer materials with high pollutant potential and their implications for adding economic, social and environmental value. New ventures, especially those focused on waste those are complex to collect, reuse and recycle, have an even more relevant role in efforts to promote the sustainability necessary for our present and future.

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