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An overview of the environmental awareness about waste tires in Paragominas town - PA

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Abstract

Waste tires, when they are not properly managed, become a major factor in environmental degradation. The objective of this study was to characterize the knownlegment and environmental consciousness level of establishments that manipulate or deal directely with tires in the town Paragominas – PA, as well as its commitment level with the legislation about the reverse logistics applied to discard of waste. This is an exploratory study, associated to a survey of bibliographic data with a temporal cut for the last 10 years, besides the application of interviews and socioenvironmental forms as data collection procedures. The results indicated that only 3.33% (CI: 0.00-8.71%) of the enterprises have a high-level understanding about the reverse logistics. The numbers were also worrisome in relation to the knowledge of Law No. 12,305:2010, in which 40.00% (CI: 25.33-54.67%) of the companies said they did not know. Despite the lack of normative instructions, 100% of the visited companies showed a desire to take part in reuse projects and/or recycling discarded tires. As a proposal for the problem, it is worth mentioning the application of alternatives that allow the reuse of waste tires in medium-large scale.

Keywords: Environmental degradation; Tires; Reuse

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1 Introduction

The technology progress and population growth explosion in the half 20th century promoted the exponential increase of quantity and types of waste produced by society. The non biodigest material creation, especially, contributed for the establishment of a crisis of environmental disposal of these waste, it is because of the major of solid waste are not submited to a correct environmentally final disposal (LAGARINHOS; TENÓRIO, 2011).

Among the several types of incorrectelly discarded solid wastes, the tire without lifespan is a case that concern a lot of environmentalists, government and society, these are called unserviceable – or waste - tires. Over two centuries, the tire is part of humanity history, due benefities generated in displacement on wheels, and have as principal raw the rubber, achieving 48% in composition of wheels indicated to light cars (BRUNETTO; PASSOS, 2015).

The used tires generation is associated to the quantity of existing vehicles in a country. In Brazil, according to the mensal reports published by Transit National Department – DENATRAN, the national frote registrated in August 2015 totalized 89,400,061 vehicles with plates of diverses types. In the same period of the years 2014 and 2013, the quantity of vehicles registered in the national territory was 84,892,511 and 79,735,990, respectivelly. Therefore, it notes a growing rise of vehicles quantity in circulation in the country, and along with this growing, there are the worries about the destiny that is given to unserviceable tires (DENATRAN, 2015).

The tires that are not recycled end up improperly discarded in waterways, *lixões* and roads, providing problems to public health. When they are burned, for instance, the combustation subprodutcs (CO, SOx, NOx, Policíclic Aromatic Hidrocarbons – PAH, dioxines e furanes) can cause mental confusion, vertigo and respiratory tract problems. It's also worth highlighting the visual polution due to accumulation in unadequated places, this is what causes the free proliferation of venomous animals and diseases transmissers mosquitos (HENKES; RODRIGUES 2015).

In the face of the great quantity of residuals (because tire has a fundamental and unplaceable role in daily life) and its incorrect discard, there is the necessity of special attention to this problem. For this, the Municipality Solid Waste Integrated Management Plan – MSWIMP defines which decisions, actions and procedures must be adopted in group in order to keep the town cleaned, by englobing phases articulated among them, from the generation to the final disposal, in compatible activities with the environmental sanitation sistems, that envolve the public power, the private initiative and the civil society organized or not (FIDELIS; SILVA, 2017).

The Solids Waste National Polícy – SWNP, law number 12.305 of 2010, consider the unserviceable tires as a passive of all economy agents envolved in the product life cycle. The law emphasizes important concepts as the integrated manegement of residuals, shared responsability and reverse logistics, as possible tools to be used to reduce the harms caused by environmentally incorrect discard of the waste (BRASIL, 2010). The reverse logistic, especifically, is a SWNP instrument that has as focus the return of materials already used to the produtive process, directing its reuse or apropriated discard and the environmental preservation, as explains Andrade (2010).

According to SWNP, it is required to structure and implement reverse logistic systems the manufacters, importers, distributers and sellers of the following products: agrochemicals, its residuals and packages, as other products which package, after using, are constituted by dangerous waste; batteries; tires; lubrificant oils, its residuals and packages; fluorescent lamps, of sodium and mercurium vapour and of mixed light; and eletroeletronic products and its components (BRASIL, 2010).

Therefore, the waste tires, when inadequatelly managed, can become an environmental degradation factor, what justify the information production about the current situation of these residuals management. In indirect way, such information is necessary to estimulate the minimization of the harms due to the inexistence or bad management of this environmental passive. As a result, the present study aimed to characterize the knownlegment and environmental consciousness level of establishments that manipulate or deal directely with tires in the town Paragominas – PA, as well as its commitment level with the legislation about the reverse logistics applied to discard of waste tires.

2 Metodology

In relation to the framework, it is made an applied work research (SAKAMOTO; SILVEIRA, 2014) with qualiquantitative approach (PRODANOV; FREITAS, 2013) and objective situated in exploratory level (SEVERINO, 2017). About the procedures, it was made a bibliographic research (LAKATOS; MARCONI, 2010), with the intention to support and reference the study understanding, covering published articles which keep relation to the proposed study. The bibliographic research was performed with time interval between 2008 and 2018, that is, in the last 10 years, using available scientific journals in the following bases: Superior Staff Aprimoring Coordenation (CAPES) homepage, bibliographic database of Scientifc Electronic Library Online (SciELO) and Google Scholar. The keywords used in the search were: "unserviceable tires", "reverse logístics", "solid wastes", "National Policy of Solid Wastes", "recycling", "reuse", "discard" and "environmental impacts". The research was also developed in field (GIL, 2009), with data collecting *in loco*. As resources to the field phase, it was conducted a survey with members of the town public administration and it applied socioenvironmental forms to enterprises that carry out tire replacement services or just its trade. As explains Silva and Porto (2016), the forms are research instruments used to designate a collection of questions that are asked and written down by an interviewer, in a "face-to-face" situation with the interviewed, with the aim to obtain data which is important to the research.

The interviews with the public administration sector happened in a semistruturated way, since it had just a basic script of previously established questions, what permited to include other set of questions which was not initially planned, proporcioning bigger freedom to introduce or exclude questions along the dialog. The first interview was executed on September 10th of 2018, having as interviewed a representant of Paragominas Municipal Secretariat of Urbanism (SEMUR). While the second interview was hold on September 13th of 2018 and it was interviewed the responsible technician for the Municipal Controled Landfill. The approach focus were questions referenced to the municipal actions developed for the solid waste management in the town, more especifically to the waste tires destination.

The socioenvironmental forms were adapted from the studies of Fidelis and Silva (2017), and applicated to the stock responsibles and coworkers who were directelly linked to the management of inserviceable tires, with the purpose of analyse the environmental consciounsiness of these social actors, mainly in relation to the destination that is given to the waste, as well as the evaluation of knowledgment and obsevance of laws about scrap tires discard. The data survey by the form ocurred from September 6th to 9th of 2018, with verification of 30 businesses that are directelly related to the purchase and sale of tires. The sample quantitative was determined by logistic conditions available to the research staff.

The statistic analyses of forms data consisted in calculum of relative frequencies of answers given by the interviewed people, they were taken as proportions referent to each answer. It was calculated, then, the respectives intervals of confidence to a 90% level confidence.

Study Area

The research was made in Paragominas, based in the southeast mesorregion of Pará, under coordenates 02º59'08" S and 47º19'57" W. The town, which main access ways are PA-125 road - from BR-010 - and PA-125, has area around 19,342.25 km^2 and its population is estimated to 110,026 habitants, resulting in populational density of aproximately 5.69 hab./km^2 (IBGE, 2017).

In relation to the biophysics, the weather of Paragominas is hot and humid, with annual average of precipitation, relative humidity of the air and temperatue of 1,800 mm, 81% and 26 °C, respectively, checking it from July to November a low hidric availability, condition that subordinate a vegetation to diverse phases of use and conservation, distributed among submontane dense rainforest, lowland dense rainforest and alluvial dense rainforest (PINTO et al., 2009). The altitudes vary from 50 m to 200 m in most of the territory and the soil is mainly of Latossolo Amarelo type (95%), drained by a hidrographic web composited by two main basins: the Capim and Gurupi river basins (PINTO et al., 2009). About economy, Paragominas - PA has in its territory a representation of major Amazon economic ativitites: little, medium and large scale cropping, livestock, woody activity, coal production, reforestation and mining, especifically bauxite. In group, these activities move the industry and services sectors, turning them the main sources of PIB and employments of the town (MACIEL et al., 2017).

The vehicles fleet, mostly passenger cars and motocycles, have been growing in Paragominas, as in all national territory. According to the data published by IBGE in 2010, in this year there were about 18,029 vehicles in the town, and in 2016 this number had a leap of 90.92%, achieving 34,422 vehicles registered. From this amount, 74.05% were motorcycles, passenger vehicles and pickups (Table 1).

Table 1 – Vehicles fleet in Paragominas

Vehicles class	Fleet (2010)	Fleet (2016)
Auto	3,846	7,640
Truck	1,198	1,454
Tractor Truck	227	352
Pickup	1,571	2,698
Station Wagon	215	336
Microbus	23	64
Motorcicle	7,692	15,150
Scooter	2,118	4,361
Bus	135	184
Wheel Dozer	0	3
Utility Vehicle	82	210
Others	922	1,970
Total	18,029	34,422

Source: IBGE (2016).

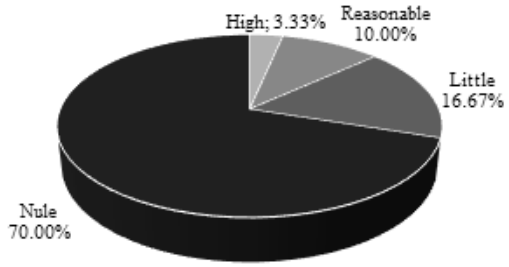
However, the fleet increase comes with the waste tires generation, and the majority of them are inapropriatelly disposed. As stated in the Pneumatic Industry National Association – ANIP (2014), the sells of new tires in Paragominas achieved 22,400 units, on average 0.80 tires per vehicle in circulation in 2013. Slightly inferior number in relation to the national consumption, that answered by the selling of 72,600,000 tires, representing a rate of 0.89 new tires selled per vehicle in the year of 2013 in Brazil. It must be emphadized that the access roads to Paragominas are in conservation state that can be considerade good, in relation to the overall condition of paviment. Equally, great part of intraurban roads present tracks with good traffic conditions. However, a significant part of paragominense fleet run regularly in the countryside or is based on it, where the rolling infraestructure is rustic, with ways without pavimentation and unleveled parts, fact that surely influence the change frequency of tires and others auto components.

3 Results and Discussion

In respect to the knowledge level about reverse logistics of businness which work with tires, the data indicated 70.00% (CI: 56.28-83.72%) of these ones claimed to have

nule knowledge or don't know the subject, 16.67% (CI: 5.51-27.83%) have little or minimum knowledge, 10.00% (CI: 1.02-18.98%) have a reasonable knowledge level, and just 3.33% (CI: 0.00-8.71%) already work with a high level of knowledge about reverse logistics systems or others tools related to the implementation of shared responsability by the life cycle of products (Figure 1).

Figure 1 – Level knowledge of business about reverse logistics



Source: authors (2018)

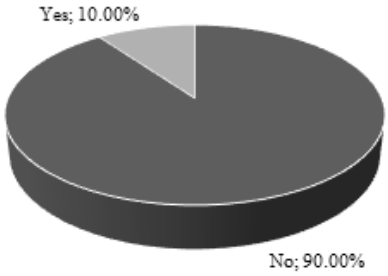
It is observed that there is a worrying tax of enterprises who have the minimum knowledge about reverse logistics. This frame, as reported by Ladeira, Vera and Trigueiros (2014), can be atributted to the fact that business owners aren't concerned in a greater deepening of theory and pratice in work environment, what can be linked to the lack of interest in searching information on a theme directly related with the respective acting segment.

This knowledge involves the opening to what Henkes e Rodrigues (2015) enhanced to be an important competitive diferential, facing the reverse logistics as something that transpass the legal obligation. A good strategy for reverse logistics programs is to make partnerships with cooperatives and recyclable material catchers, since these are fundamental actors of brazilian recycling chain, they are capable to viabilize reverse flows and generate economic and socioenvironmental benefits, mainly when there are integration among firms, cooperatives and the public power. This articulation, however, can't be done without an adequated support to the structural adaptation of catchers.

When it is verified if the companies search or offer some information about reverse logistics in Paragominas-PA, it was determined from data analyse that 90.00% (CI: 81.02-98.98%) of companies do not worry to obtain or inform aspects on the subject, and just 10.00% (CI: 1.02-18.98%) showed interest (Figure 2).

With a high percentage of companies that do not concern in searching or offer information on reverse logistics, it was identified a lack of knowledge and conscientization that could be affecting the economy, as well as the people and environmental health. On the other hand, the studies of Amorim (2015) in Três Corações town– MG concluded that 65.00% of companies related to buy and sell of tires search informations about reverse logistics, through legal directives, suppliers orientations and city hall or even by web and newspaper, but a significant

Figure 2 –Search or offer of informations about reverse logistics by firms



Source: authors (2018)

percentage of 35.00% of legal establishments claim not to search any informations about it.

Santos, Fontana and Machado (2017) enhanced that the implementation of reverse logistics avoid losings, estimulate the sustainable consumption and redirect the marketing of enterprises turned to buying/selling of tires. It sounds good, cause it generates the oportunity of new business, reduce the pression over the natural resources, the public health and the environment.

The firms were asked if they were aware about the Law nº 12.305 of 2010, that instituted the National Policy of Solid Wastes (NPSW). The data analysis permited checked that 60.00% (CI:45.33-74.67%) of visited enterprises said to be aware about the law, while 40.00% (CI: 25.33-54.67%) did not know or never got any informations on the NPSW (Figure 3).

Figure 3 – Knowledge of enterprise about Law n° 12.305 of 2010, that institute the National Policy of Solid Waste

Source: authos (2018)

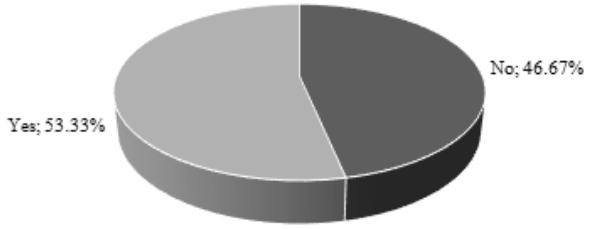
Although most of enterprises have some knowledge (60.00%), 40.00% do not demonstrate initiative in obtaining any information about the NPSW yet. Similar results were observed in Fidelis and Silva (2017) study in Rio Verde – GO, where 65.00% of analyzed firms said to know the NPSW, while 35.99% did not know about it. The Machione (2015) study in Calina-SP showed worrying numbers, concluding that 66.65% os enterprises related with buying and selling of tires informed know nothing about the NPSW, but knew about prohibition of randomic discard of unserviceable pneumatics.

As reported by Granja (2011), with the use of information booklets on this law and the offer of presencial

support to the firms, the interest in preserve the environment and the regularization about the vigent environmental legislation could increase widely. Henkes and Rodrigues (2015) also enhance the knowledge of NPSW by the firms involved in any way in the distribution tires chain, it is very important to these business do not incur in punishing actions.

In respect to the knowledge or work of firms with some reutilization or recycling program of tires, the data analysis indicated that 53.33% (CI: 38.40-68.27%) have a specific final destination to the unserviceable tires different from the burning or discard in the controled landfill of city. In this case, it is common the donation of this material to organizations that work with the fabrication of artefacts and landscaping, or especialized enterprises in tires recycling and production of rubber plates for sport courts, fabrication of punching bags and fabrication of sinthetic grass. In relation to the percentage of enterprises that do not practice the alternative discard for this waste, around 46.00% (CI: 31.73-61.60%) of firms, the final destination to waste tires is the controled landfill of municipality (Figure 4).

Figure 4 – Knowledge or involvement of enterprise with some reutilization ou recycling program of tires



Source: authors (2018)

Conforming to Municipal Secretariat of Urbanism (SEMUR), the City Government is not responsible to do the collect of unserviceable tires in the establishments of pneumatics trade, except if these ones are placed in public ways. The position of City has foundation in the CONAMA resolution nº 416 of 2009, that in Art. 1st to determine the manufacturers and importers of new tires with unitary weight above 2 kg to give flow of this waste to the appropriate final destination, although ordenating the articulation of manufacturers and importers with the Public Power, distributers, resellers, destinators and final consumers to the implementation of collect unserviceable tires in the country. However, the controled landfill of the town, receive significative quantity of waste tires, which are redirected to a specific cell (Figure 5), in which are just the discarded tires. In this aspect, the cited resolution is not observed, because in its Art. 15 it is fixed the prohibition of tires disposal in sanitary landfills.

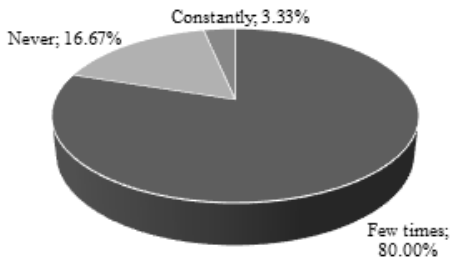
Figure 5 – The disposal of unserviceable tires in the controled landfill of municipality

Fonte: authors (2018)

In complement to the information delivered by SEMUR, the coordenation of controled landfill of Paragominas informed that the tires are temporarily disposed in the site, with the aim of acumulating a considerable volume to be fowarded to a pneumatics recycling firm. However, in the ocasion of authors visit to the landfill, the temporary disposal of the tires have not ensured the necessary conditions to environmental and public health damage prevention, being in disagreement to what say the Art. 10 of CONAMA resolution nº 416 of 2009, which do not allow the storage of tires in open space.

In the applied form, it was also questioned if the firms that trade the pneumatics receive or have already received any type of support from the fabricants/suppliers to do the right destination of unserviceable tires. In this item was observed that 80.00% (CI: 68.02-91.98%) of them have never percepted support from fabricants or suppliers, 16.67% (CI: 5.51-27.83%) received support few times and, just 3.33% (CI: 0.00-8.71%) of firms receive support from suppliers constantly (Figure 6).

Figure 6 – Receiving of support from fabricants/suppliers of tires



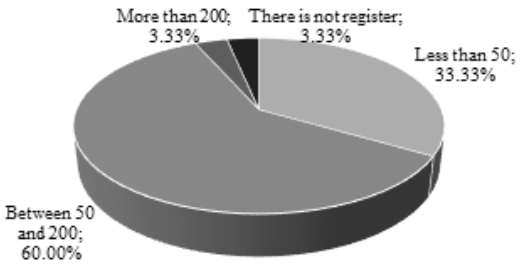
Source: authors (2018)

This result meets what is determined by Art. 33 of NPSW, by which the fabricants, importers and distributers of tires are obligated to structure and implement systems of reverse logistics, in face to the return of products after using by the consumer, independent from public service

of urban cleaning and of solid wastes management. Lobo et al. (2016), enhance the importance of reverse logistics while the manufacters inclusion promoter, traders and consumers in the application of shared responsability institute, that is attributed to the task of developing plans to the no-generate and to the correct destination of products after its lifespan or after its consumption, by investing in the fabrication of products which are able to be recycled and reutilized, by partnership with consumers to the minor generation of residues or by colaboration of cleaning public services titulars, with the adequated management of solid wastes.

When the enterprises are questionated about the quantity of discarded tires, the declared data analysis enabled to infer that 60.00% (CI: 45.33-74.67%) of enterprises discard between 50 and 200 tires per month, 33.33% (CI: 19.22-47.45%) discard less than 50, 3.33% (CI: 0.00-8.71%) discard more than 200 and 3.33% (CI: 0.00-8.71%) do not have a monthly register that quantify the discards of unserviceable tires (Figure 7).

Figure 7 – Mean of discard of unserviceable tires



Fonte: authors (2018)

There are, in this case, a medium estimative of 10,740 discarded tires to the period of one year in Paragominas town. This great quantity of discarded tires elevate the pressions over the environment and the public health in case to be disposed in inapropriated places. Besides that, there is a worrying parcel of 3.00% that do not register the discarded fraction monthly, it can elevate the quantity of material that could be recycled or reutilized to others purposes. In the same way, in Fidelis and Silva study (2017) in Rio Verde – GO, it was observed that 61.00% of enterprises that are directly related to the buying and selling of pneumatics discard between 50 and 200 tires per month, 26.00% discard less than 50, 4.00% discard more than 200 and 9.00% do no have register.

In this context, due to not have a great search of knowledge in the reverse logistics area or about the National Policy of Solid Wastes, the situation displayed the incapacity of most of firms to include in its designation plan of solid wastes, when it exists, the reuse of residues. As data showed, the lack of information obstruct the capacity to perform an extensive capture, indicating that suppliers, firms and city hall need an intensive comunication, producing and interchanging information in a constant way and expanding recycling options. It is important to enlarge that although the most of enterprises do not present knowledge about the reverse logistic systems, all (100%) showed available to help in the collection of tires that do not fit anymore for the consumption and to use it in reusing or recycling projects.

4 Conclusion

The level of environmental conscientization of establishments responsible people that manipulate or directly deal with tires in Paragominas is regular, around 54.00% of firms that participated of this research has a good level of commitment with the final discard of waste tires. It is valid to highlight that both great business and the small business try to avoid that unserviceable tires are acumulated in an inapropriated way.

However, the most of firms do not know about reverse logistics systems and do not appreciate the Law nº 12,305 of 2010, that institute the National Policy of Solid Wastes. Additionally, it was observed thar the most of visited establishments do not receive the support of suppliers in relation to an appropriate destination of unserviceable tires, what implies the lack of information and of the reverse logistics system implementaion for its residue. Although the lack of plans of solid wastes designation, the firms feel the importance of reusing and/or recycling projects for unserviceable tires and showed willing to implement actions to it.

For future works, it is recomended that the surveys are able to evaluate the alternative ways of discard or reuse the tires in the local establishments. A very common example of reusing would be the utilization of waste tires in the asphaltic mass composition, with the addition of rubber in asphaltic mixes.

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