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Implementation of environmental management tools to support the management of solid waste in the municipality of Rio Tinto – Paraiba state, Brazil

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ABSTRACT

The question of waste has become the subject of several discussions, since it affects the social, political, economic and environmental. The waste production is related to human activities, and excessive consumption and program obsolescence increase generation. Thus, this research objective to study the issue of solid waste in the municipality of Rio Tinto/PB, trying to analyze the social factor, which incorporates the local population; factor generation of waste, identifying the main waste produced; factor collection and packaging waste, evaluating the collection system from its storage to final disposal; and finally analyze the need for environmental management in the region. Therefore, we designed a questionnaire. It was noticed that the city of Rio Tinto has a high social vulnerability, a deficiency in the waste collection system and presents a great need to apply the practice of environmental management.

Keywords: environment, solid waste management, Paraíba

INTRODUCTION

The production of waste is an inherent factor to almost any human activity. Consumer habits are constantly changing and therefore is difficult to see the pace or the speed with which the materials that no longer serve us (or that have become obsolete, by fashion effect), they are discarded. (CHÁVEZ; MANZANARES, 2011).

According to Gödecke et al (2012), the world population is increasing rapidly, given that the mark of seven billion has already been exceeded. A most populous and growing urbanization require a

greater demand for ecosystem services, whose depletion occurs either by use for the production and consumption, as the return damages arising from the waste to nature after its use by man.

According Albertin et al (2010) until the Industrial Revolution, the very nature took care to decompose this waste. But from that time, the amount and chemical characteristics, physical and biological waste these were changing. Adding to this, there was an intense population growth, and encouraging consumption. All this greatly increased the generation of solid waste, but the ability of decomposing the same by nature remained the same. The development of our urban industrial society, to know no bounds, took place in a disorderly manner, without planning, at the expense of increasing levels of pollution and environmental degradation (ROCHA, 2007).

According to Article 3 of Law nº 12.305 (BRAZIL, 2010), solid waste is material, substance, object or well disposed resulting from human activities in society, whose allocation is carried, it is proposed to proceed or is required to do in the states solid or semi-solids and gases in containers and liquids whose characteristics make it impossible to launch the public sewage system or water bodies, or require it to technical or economically viable solutions in light of the best available technology. For ABNT (2004), solid waste or trash is defined as the rest of the human activities of industrial sources, domestic, commercial, hospital, among others, are considered useless, useless or disposable, and may present themselves in solid, semisolid or liquid.

Within the issue of solid waste generation, there is an imbalance in the consumption/production of waste/environment, having in mind that, for lack of implementation of a policy of integrated management of solid waste every day resources environmental are wasted, increasing the environmental damage resulting from pollution caused (Costa, 2010). For Mansor et al (2010, p. 20) "management of solid waste comprises all the strategic decisions and actions aimed at seeking solutions to solid waste, involving policies, instruments and institutional and financial aspects."

Silva (2005) confirms that the great impasse is that natural systems are already so depleted by the large amount of waste that is produced, which can not reintegrate them in their biogeochemical cycles satisfactorily. Thus, the "garbage" is now considered one of the most responsible for environmental pollution and the problems of social order and public health. Given this context, this research aims to understand the issue of solid waste in the municipality of Rio Tinto/PB looking to make an analysis of the social factor, which incorporates the local population; factor generation of waste, identifying the main waste produced; factor collection and packaging waste, evaluating the collection system from its storage to final disposal; and finally analyze the need for environmental management in the region.

MATERIALS AND METHODS

1. Caracterização da área de estudo

The city of Rio Tinto is located in the micro region of the North Coast and in the middle region of Paraíba Forest is located at 06º 48'22 " south latitude and 35º 04 '34"longitude west (Figure 1). With land area of 466 square kilometers, representing 0.8264% of the state, 0.03% of the region and 0.0055% of the entire Brazilian territory. According to the census of 2010 (IBGE) the municipality has a population of 22,947 people. This council consists of 44

communities (Table 1), 10 of them urban and 34 rural. Rural communities only five are favored with the collection system, and only one, the Jaragua community, the collection made is every day (Table 2).

Figure 1 – Location Rio Tinto municipality in Paraíba. Source: Authors, 2016.
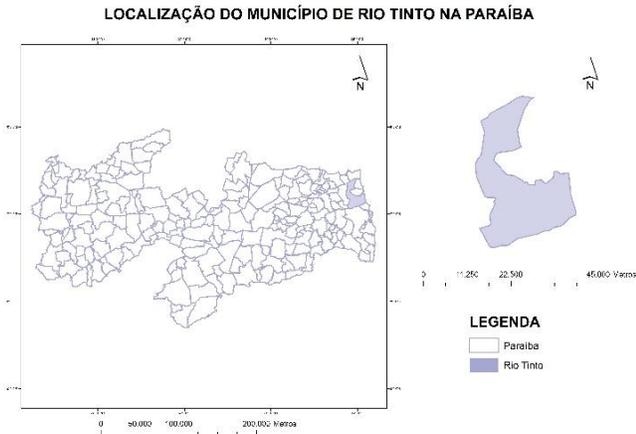
Table 1 – Urban and rural communities in the municipality of Rio Tinto-PB. Source: Rio Tinto Prefecture 2011.

Regions	Urban communities municipality of Rio Tinto / PB	Rural communities in the municipality Rio Tinto / PB
Regions I	Salema de Fora e Salema de Dentro (Salema)	Maracujá, Curral de Fora, Piçarreira, Rua Nova, WI e Rua do Ouro.
Regions II	Vila Regina, Regina I e II, Jaqueira	Jaraguá
Regions III	Centro da cidade, Conjunto Eduardo Ferreira, Cinco Ruas e Veloso	
Regions IV		Taberaba, Areia Branca, Boa Vista e Rio do Banco
Regions V		Cravassú, Aritingui, Sapucaí, Tavares, Pacaré, Tatupeba, Buraco e Caranguejeira
Regions VI		Praia de Campinas, Tanques, Lagoa de Praia, Barra de Mamanguape e Saco
Regions VII		Piabuçú, Campart II, Cajarana, Águas Claras, Jardim, Silva de Belém, Itauna, Itaepe, Capim Azul e Boréu

Table 2 – Favored and not favored communities of thier garbage collection in the city of Rio Tinto-PB. Source: Rio Tinto Prefecture 2011.

Communities favored with the collection (every day)	Communities favored with the collection (twice a week)	Communities that are not favored with collection
Regions I	Salema de Fora e Salema de Dentro (Salema)	Maracujá, Curral de Fora, Piçarreira, Rua Nova, WI e Rua do Ouro.
Regions VII		Piabuçú, Campart II, Cajarana, Águas Claras, Jardim, Silva de Belém, Itauna, Itaepe, Capim Azul e Boréu

For the research chosen were five communities, three of them urban and two rural. The choice of only two rural communities was due to access these. The chosen urban communities were Salema Inside, Outside Salema and Rio Tinto City. Rural communities are Jaraguá and Maracujá.

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2. Coleta de dados

First, we performed a literature review on the topic in question enables a greater understanding of the subject. They were raised secondary data in public agencies regarding the collection, transport and disposal of waste generated by the city of Rio Tinto / PB. In order to identify and quantify the waste generated by Rio Tinto municipality, in addition to an analysis of the issues surrounding the issue of it in the city, as well as calculate the social vulnerability of communities, it elaborated was as a research instrument a questionnaire, which applied was in the five selected communities. The same consisted of four topics to facilitate the analysis and processing of the results. Eight questionnaires administered were in each community, which totaled forty throughout the municipality.

As for the questionnaire, the first topic deals with the personal data and some social variables (social

factor), with the intention to assess the relationship between man and the environment, taking into account the socio-economic issues. In the second topic, data questioned are on the production of household waste (waste production factor) in each household, thereby sought to measure and quantify what the main waste produced in the municipality. The third topic of the questionnaire, questions are asked regarding the collection and packaging of waste (factor collection and packaging), thus evaluating which the primary means of storage of waste and destinations given to these by communities. In the fourth and last topic, questions concerning the need for domestic waste management were addressed, (waste management factor) at this point sought to evaluate the environmental awareness of population problems from waste faced by it, and from there to diagnose the need to implement environmental management in the municipality.

RESULTS AND DISCUSSION

2. Collection, transportation and disposal of waste in the municipality of Rio Tinto.

Many small Brazilian cities, Rio Tinto municipality has a deficiency in relation to the management of solid waste, where only 32% of the communities are favored with the collection (Figure 2), ie more than half of these communities are not benefiting from the the collection system. According to Ferreira et al (2016, p.99) "provide an appropriate target waste is one of the great challenges of public administration not only in Brazil but all over the world."

Waste collected in the Rio Tinto municipality are transported by four trucks, one of which is shown in

figure 3. The collection is carried out by people who do not use any protective equipment such as gloves, masks and boots.

Figure 2 – Frequency of collection in Rio Tinto county communities. Source: Authors, 2016.

- Six times a week
- Twice a week
- No collection
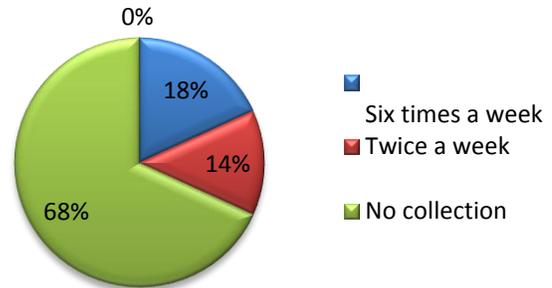
Figure 3 - Garbage truck. Source: Authors, 2016.

The collected material is disposed of in the landfill without any treatment (Figure 4). This is located in BR101, will approximately 9 km from the city.

Figure 4 - Dumping ground. Source: Authors, 2016.

To Mucelin and Bellini (2008), situations of pollution by improper waste disposal cause negative environmental impacts in different ecosystems of the city, such as banks and riverbeds, street banks and roads, valley funds and vacant lots. Mismanagement of these also entails various impacts of social context. The poor packaging of solid waste in landfills become an attraction for people, including children, seeking livelihood. Scavengers manipulate materials without protective equipment, endangering their own health. Apart from that, this bad mood, favors the appearance of some animals, that when they come into contact with the man cause some kind of disease.

According to Costa (2010), there is a growing concern with the solid waste management policies produced by humanity, in order to minimize its use and reuse them, seeking further recovery (recycling and composting) of this waste, reintroduzindo- in the production chain all other waste generated within an integrated and participatory management system and waste management.

3. Data analysis

3.1 Personal factor

An important factor in relation to the social aspect of this community is its distribution between urban and rural region (Figure 5), with 33% of respondents living in urban and 77% in rural areas.

Figure 5 – Distribution between regions. Source: Authors, 2016.
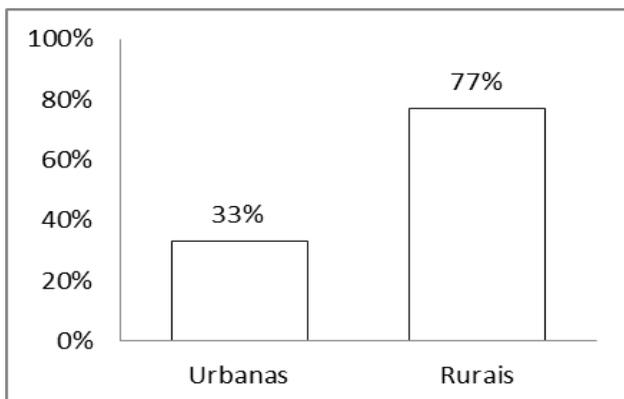
As for the level of education (Figure 6) communities showed worrying data, 15% of illiterate respondents, 30% have not completed primary education; ¼ to complete high school, and only 3% have higher education. This result shows a low level of education, these communities.
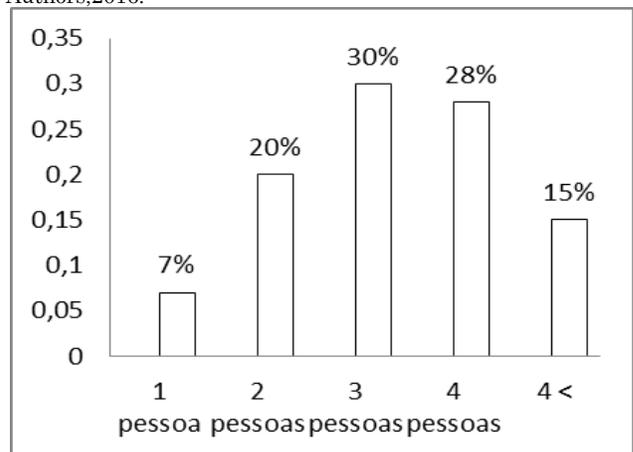
Figure 6 – Level of education. Source: Authors, 2016.
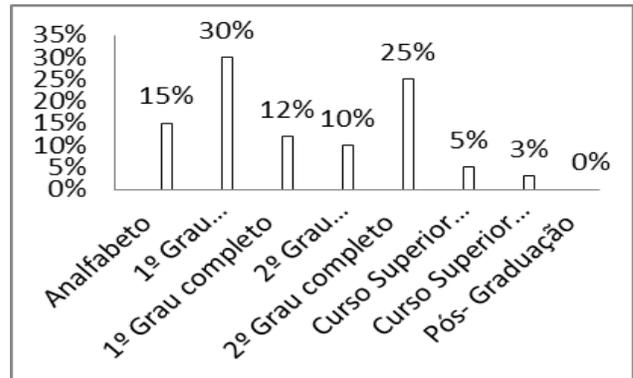
To Araújo (2010) this implies a serious social problem, because the population does not have knowledge nor information necessary for decision-making and local management.

Figure 7 shows the numbers of people living in each household.

Figure 7 – Number of people living in households. Source: Authors,2016.

Few families are made up of two people (7%), most of them (30%) are made up of three people, 28% have four people living in the same household and 15% of households have more than four people in a single household, according to some respondents, their homes support up to eight people, and many of

these families survive only on minimum wage, as shown in figure 8, where the income of most of these families do not exceed more than five minimum wages, with 62% of families staying with only one salary, and 38% with an income of one to five salaries. This only further justifies why such a high rate of social vulnerability.

Figure 8 – Monthly income. Source: Authors, 2016.
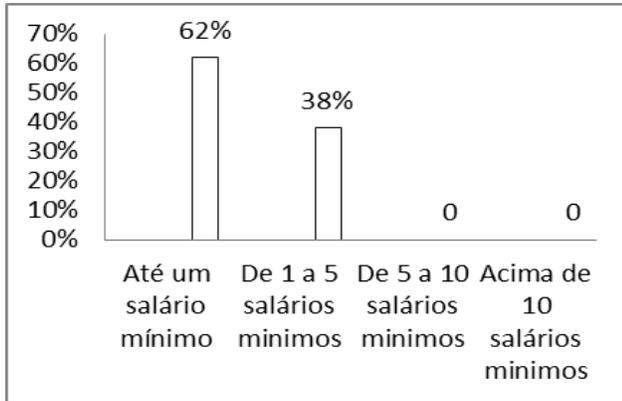
The residences are primarily rural, where 60% live in places, 20% in villages and only 20% in cities themselves. The predominant type of housing is brick houses in good condition.

3.2 Factor of waste production

As shown in Figure 9, 97% of meals are prepared at home, that is, according to this variable exists a great generation of organic waste in these communities. However, the frequency of daily meals (Figure 10) in the majority of residences (55%), no more than three times, and only 33% was fed over four or five times a day.

Figure 9 – Preparation of meals in the home. Source: Authors, 2016.
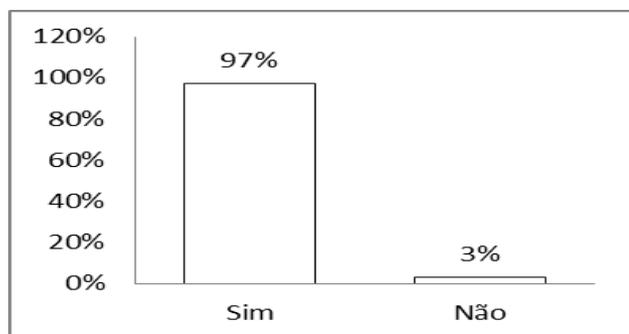
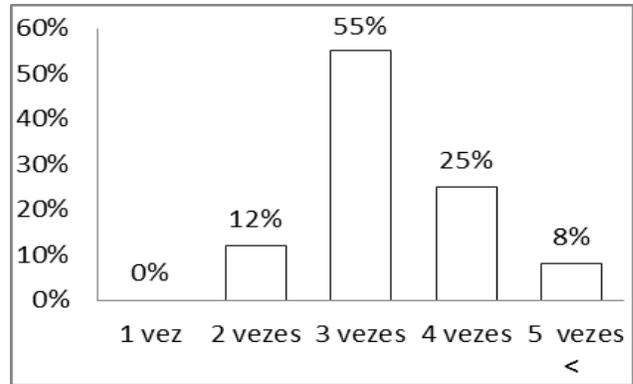**Figure 10 –** Daily frequency of meals. Source: Authors, 2016.

Figure 11 shows that 87% of the remains of those meals will for animals, such as pigs, chickens and dogs, as most people interviewed creates some kind of animal in your home. So few of the meals remains is for the collection, only 5%.

Figure 12 identifies which principias types of waste produced by communities from Rio Tinto, these being: food debris (31%), followed by plastics (28%), paper (25%), glass (12%) and metal (4%).

**Figure 11 –** Fate of the remains of meals. Source: Authors, 2016.
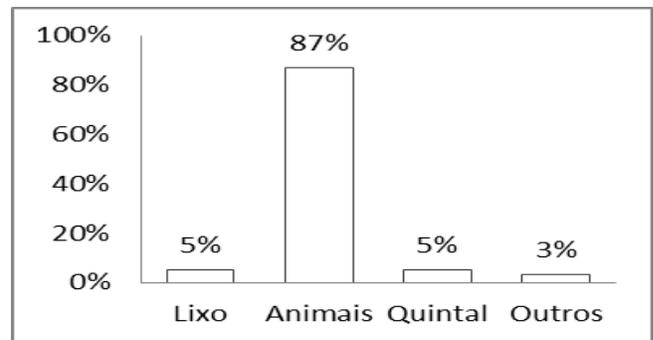
Figure 12 – Types of waste produced. Source: Authors, 2016.
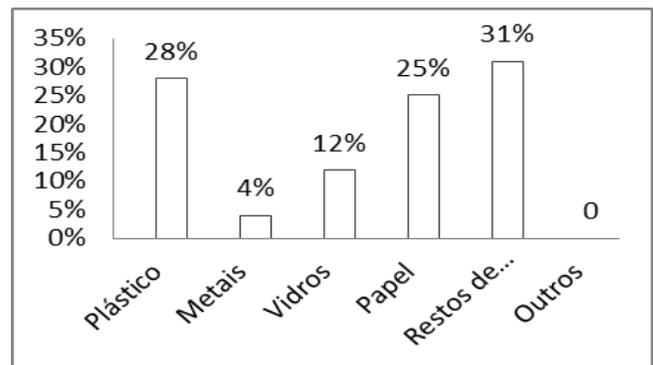
As already said the food scraps are intended for domestic animals, other materials are collected,

burned or donated to a collector, this varies from household to household and community to community. In the community of Salema de Fora and Salema de Dentro many residents said donating bags and plastic bottles for any collector. Showing therefore some concern about the disposal of these materials. Showing therefore some concern about the disposal of these materials. But when they were asked if they regularly make the sorting of waste (Figure 13) 65% said no, saying that not separate the trash, because at the time of collecting all mixes. 35% separating the garbage, most separates plastics (which are donated) of food debris, and other mixed materials.

Figure 13 – Separation of waste. Source: Authors, 2016.
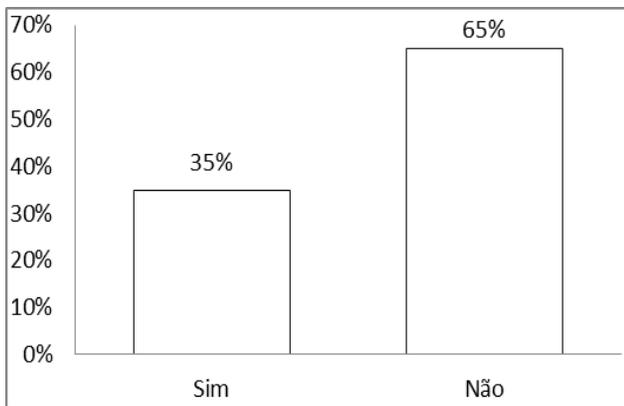

3.3 Factor collection and packaging

To assess what the main means of storage of waste and destinations given to these, communities, some questions were highlighted namely: waste storage generated regular frequency of garbage collection and the community is aware of what will be selective collect.

Figure 14 shows that 75% of people store their waste in plastic bags, 10% use the burning, to give destination to the waste produced. People who use this method say that garbage collection does not pass in their homes and to prevent the spread of disease, the only solution is to burn. Only 2% use cardboard boxes for storage and use buckets 13% to store wastes. In this case when the vehicle responsible for the collection arrives, the residues from the buckets are emptied, the bucket remains in the residence.

In figure 15 is shown the frequency of collection in the communities of Rio Tinto municipality, 30% of households are favored by collecting six times a week, it takes place in the community center (urban) and in the community Jaraguá (rural), 15% of households do not benefit the collection, these are the Salema de Fora community, that community trash generated has two destinations, or serve as food for animals (organic) or are burned. The whole community Salema de Dentro is favored with the collection for two times a week, this frequency also occurs in part of the Salema de Fora community and Maracujá, which is equivalent to 35% of households. The rest of the community residences Maracujá is only benefited from the collection once a week (10%), residents believe that this is due to the difficult access, they still claim that there are weeks in which the collection does not pass, forcing the same to burn the trash, not to attract transmitting animal diseases. Some residents of the community Jaraguá said the frequency of collection varies, occurring five or three times a week (10%).

Figure 14 – waste storage site. Source: Authors, 2016.
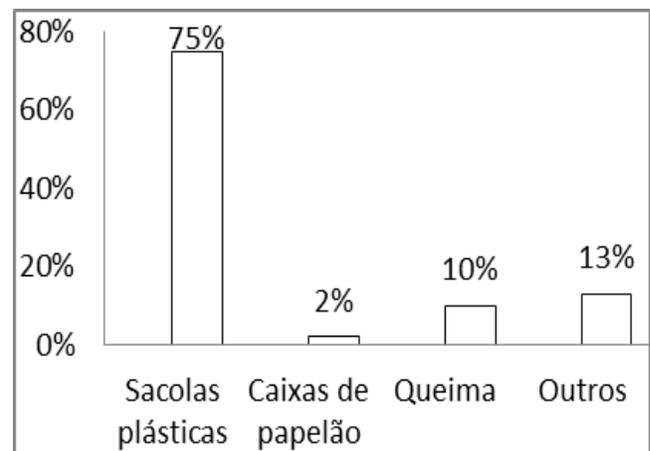
Figure 15 – Regular collection frequency. Source: Authors, 2016.
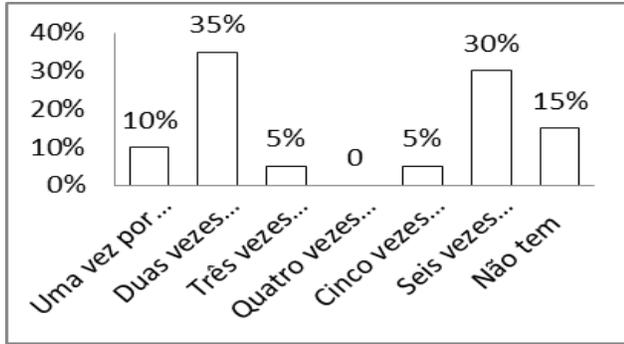
When residents were asked about what was selective collection 58% said they never heard this expression and 42% said they knew what it was, but most did not know, explain clearly what has to be the activity. This implies a lack of knowledge that many have when it comes to environmental issues.

3.4 Factor waste management

When people interviewed were asked if Rio Tinto municipality suffers from some environmental problem from the waste, 60% said yes, citing as the main problems: the proliferation of animals like flies, cockroaches and rats; clogging culverts, one of the factors that lead to cause flooding; contamination of water and wetlands; accumulation of garbage in the streets where the collection does not pass every day. According to Ferreira & Angels (2001) the effect on human health and environment of poor disposal and treatment of solid waste are numerous, the presence of municipal solid waste in urban areas is very significant, creating problems of aesthetic order, public health, for access to vectors and domestic animals, clogging rivers, channels and networks of urban drainage, causing flooding and enhancing epidemic.

It was also confirmed that 60% of respondents did not adopt any measure to reduce the amount of waste it produces, with only 40% concerned with reducing somehow the production of waste generated in their homes.

Figure 16 shows that 58% of the population interviewed does not reuse any material, 42% turn claim reusing some of the materials, particularly plastics such as PET bottles and containers.

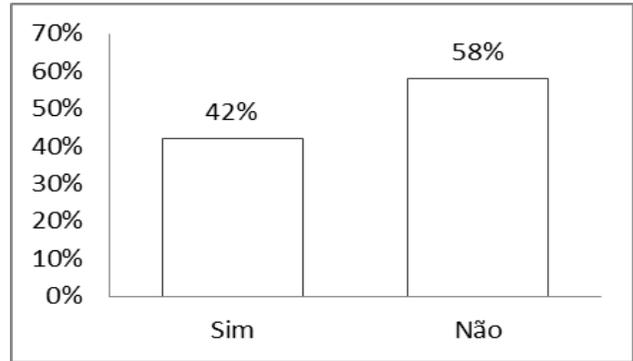**Figure 16 –** Reusing materials. Source: Authors, 2016.

Figure 17 is the main means of population information on environmental issues where, say 52%, being the television the main source of information and where 25% said they do not have any information on these topics. All these data demonstrate the lack of an appropriate policy for the management of solid waste in the city. And the importance of inserting directly to community discussions and practices aimed at improving the environmental issues in the region.

Figure 17 – Main sources of information on environmental issues involving solid waste. Source: Authors, 2016.
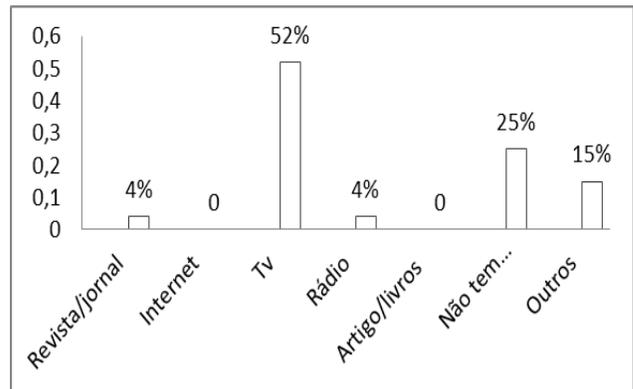
CONCLUSION

Given all that has been studied and discussed, it was found that the municipality of Rio Tinto / PB has a high social vulnerability, it shows that local

communities have social indicators, such as income, very low education, influencing directly or indirectly the behavior of these in environmental issues relations.

It was noticed that the city has certain disabilities, when it comes to the management of household waste produced, particularly in the adopted collection system, where many communities are favored by collecting only twice a week, and there are still communities that are not benefited in at any time, that is, these are required to take alternative measures to dispose of waste, since this, as mentioned by many residents, attracts many types of insects, disease vectors. The main option for these families get rid of waste, is the burning of it, which implies various environmental impacts.

According to the results it is clear the need that the city has to adopt measures to and prioritize social and environmental issues, noting that so that if you have good results work must first be viable, studying local limitations and is mainly accessible the whole community, so that there is full participation of the same in the proposed activities.

REFERENCES

ABNT. Associação Brasileira de normas técnicas. Disponível em http://www.aslaa.com.br/legislacoes/NBR n 10004-2004.pdf > Acessado em abril de 2010.

ALBERTIN, R, M.; MORAES, L.; NETO, G, A.; ANGELIS, B, L, D.; CORVELONI, E,; SILVA, F, F.; Diagnóstico da gestão dos resíduos sólidos urbanos do município de Flórida Paraná. *Revista Agro@mbiente On-line,* v. 4, n. 2, p. 118-125, 2010.

ARAÚJO, L, E.; *Climatologia e Vulnerabilidade Socioeconômica e Ambiental da Bacia Hidrográfica do Rio Paraíba – Estudo de Caso do Açude Epitácio Pessoa (Boqueirão).* 2010, 120 F. Tese (doutorado em recursos naturais)-UFCG, Campina Grande.

BRASIL. Lei nº 12.305 de 2 de agosto de 2010. Institui a Política Nacional de Resíduos Sólidos; altera a Lei no 9.605, de 12 de fevereiro de 1998; e dá outras providências. *Diário Oficial da União*, Poder Executivo, Brasília, DF, 3 ago. 2010.

CHÁVEZ, M, G.; MANZANARES, C, H, M. El manejo de los residuos sólidos municipales: un enfoque antropológico. El caso de San Luis Potosí, México. *Estudos Sociais.* v.20,n.39, p.236-261, 2012.

COSTA, S. L.; Resíduos sólidos urbanos sustentabilidade e poluição. In: 3º Simposio Iberoamericano de Ingeniería de Resíduos, 2º Seminário da Região Nordeste sobre Resíduos Sólidos, 12., 2010. João Pessoa. Anais... João Pessoa, 2010.

FERREIRA, M. G. O.; BILAR, A, B, C.; MOURA, F. F, S.; FERREIRA, L, R.; RIBEIRO, E. P. Solid waste management and environmental education from the perspective of workers of a cooperative recycling. *Revista Geama,* v.5, n.1, p.94-102, 2016.

FERREIRA, J, A.; ANJOS, L, A; Aspectos de saúde coletiva e ocupacional associados à gestão dos resíduos sólidos municipais. *Cad. Saúde Pública,* Rio de Janeiro, v. 17, n.3, p.689-696, 2001.

GODECKE, M, V.; NAIME, R, H.; FIGUEIREDO, J, A, S. O consumismo e a geração de resíduos sólidos urbanos no Brasil**.** *Rev. Elet. em Gestão, Educação e Tecnologia Ambiental.* v.8, n.8, p.1700-1712, 2012.

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MANSOR et al. Cadernos de Educação Ambiental: resíduos sólidos. Secretária do Meio Ambiente, São Paulo. 2010. Disponível em < http://www.ambiente.sp.gov.br/wp-content/uploads /publicacoes/sma/6-ResiduosSolidos.pdf> Acessado em Maio de 2016.

MUCELIN, C. A.; BELLINI, M.; Lixo e impactos ambientais perceptíveis no ecossistema urbano. *Sociedade & Natureza, Uberlândia,* p. 111-124. 2008.

ROCHA, V. G.; Resíduos Sólidos Urbanos: Análise sobre a Situação do Município da Barra dos Coqueiros/SE. *Revista da Fapese,* v.3, n. 2, p. 25-3. 2007.

SILVA, J. M. S.; *Uma revisão bibliográfica sobre resíduos sólidos domésticos e algumas considerações sobre Uberlândia/MG e condomínio Miranda V – município de Uberlândia-MG.* 2005. 118 F. Monografia (graduação em bacharelado em geografia)-UFU, Uberlândia.