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OCCUPATIONAL DYSFUNCTION IN CREATING VALUE PROPOSITION FOR RECYCLABLE MATERIAL COLLECTORS ORGANIZATIONS IN ESPÍRITO SANTO/BRAZIL

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Abstract
This study sought to identify dysfunctions in the alleged operational activities in organizations of recyclable material collectors in the metropolitan region of Grande Vitória (RMGV) / ES / Brazil. With the implementation of the Business Model Canvas it was possible to understand the areas and stakeholders involved, namely: the segmentation of the target audience; value proposal; channels; the relationship with the target audience; revenue sources; key activities; main resources; cost structure and main partners. The cognitive map proposed by the Current Reality Tree (CRT) enabled the visualization of relations between the 50 typical dysfunctions identified in relation to the main side effect (very low economic efficiency), being the majority of a cultural nature. Strategic diagnosis made with SWOT identified that the negative sides of both environments, external and internal ones, as the degeneration of the public policy and internal dysfunctions, still excel the strengths and opportunities of the organizations. The benefit of the use of these tools can provide improvements of corporative management and value creation for the segments involved.

Keywords: recyclable material collectors, operational activities, dysfunction, corporative governance.

1 Introduction
In order to allow the required progress to tackle main environmental, social, and economical issues resulting from inadequate handling of Municipal Solid Waste (MSW), the Brazilian Federal Law nº 12.305, on 2 August, 2010, established the Solid Residuals National Policy (Política Nacional de Resíduos Sólidos – PNRS; BRASIL, 2010). In this policy, it can be noticed the recommendation of alternative practices in the management of USR, such as the inclusion of recyclable material collectors organizations. This strategy contributes to the society as a whole not only for allowing

savings on USR collection and allocation expenses (GUTBERLET & BAEDER; 2008, EZEAH, FAZAKERLEY & ROBERTS; 2013), but also for focusing on solving social and environmental issues, even if the profit is not primarily intended (DENTCHEV et al.; 2015). According to Scheinberg et al. (2010), in Latin American countries, recyclable material collectors are the main responsible for rescuing the majority of the collected residuals. In Brazil, CEMPRE (2013) estimates that 90% of all recycled material is recovered by the collectors' work.

However, institutional, financial, political, and social issues still impose themselves as obstructions to the development of the activities, and also to the effective inclusion of these recyclable material collectors organizations in the USR management VELIS et al., 2012). The recyclable material collectors' activities have been widely ignored, rarely supported and acknowledged, highly exploited and even discouraged by the government, which causes the organizations to be little reciprocated by the environmental services they provide (SHARHOLY, 2008; SEMBIRING; NITIVATTANANON, 2010; GUERRERO, MAAS, HOGLAND, 2013). This unfavourable situation has been, in a relapsing manner, coped with by the Brazilian recyclable material collectors organizations, which in the majority stand in very low economic efficiency scenarios for their operations (DAMÁSIO, 2010).

Although these organization are the bottom of the recyclable material suppling chain for the Brazilian industries, they still depend upon intermediate dealings with 'middlemen' (SCHEINBERG et al., 2006; FREITAS e FONSECA, 2011; VELIS et al., 2012; TIRADO-SOTO, 2013), in addition to being under public endorsement (FREITAS E FONSECA, 2011). Thus, the organized collectors' income during the trade of the materials is lower than the profit achieved by 'middlemen' and recycling industries.

The assessment of the internal situation of the organizations as well as their dysfunctions and implications on business proposal need specific interventions. Therefore, the present study proposes the implementation of commonly used management tools, with particular attention to those which do not require high costs and technological development. In order to do that, the organizations were assessed under the institutional activities and arrangements structure perspective, with the involvement of the interested parts (public and private sectors, collectors and society). The study began by acknowledging the main significant areas to the Business Model Canvas, and moved on to the identification of the operational activities and typical dysfunctions (bibliometric research and survey). From the construction of a cognitive map, the dysfunctions were organized by using the Current Reality Tree (CRT) tool, which suited the management of the dysfunctions and the orientation of the root-causes solutions. Subsequently, the assessment of the internal and external environments of the organizations (SWOT matrix) was carried out.

2 Methods and Experimental Procedure

2.1 Methods Description

From an applied perspective, the present research has employed assessment tools to evaluate the corporative governance of the recyclable material collectors organizations in the metropolitan region of Grande Vitoria (MRGV), ES, Brazil. In order to do this, assessment tools were used to achieve each specific research aim, as succinctly described in Table 1.

Table 1. Descriptive matrix of the assessment tools used in the study.

General Aim	Specific Aims	Methods and Tools
To evaluate the operational activities in the recyclable material collectors organizations	To describe the significant aspects involving this institution model	Business Model Canvas
	To identify the operational activities and typical dysfunctions of this business type	Exploratory Survey
	To develop a cognitive map to organizes the typical dysfunctions and to focus on the root-causes	Current Reality Tree
	To describe the intrinsic characteristics to the business proposal	*SWOT*
	To consolidate and validate the corporative governance of operational activity tools generated	Focus group – speech analysis

Source: Elaborated from Choguill (2005).

2.1.1 Business Model Canvas (BMC)

The BMC is an analysis model capable of assessing in an integrated and logic way how an organization creates, provides, and obtains value, be it economic or social (OSTERWALDER et al.; 2011). Abraham (2013) & Jokela and Elo (2015) emphasize the application and functionality of the BMC in social non-profit enterprises in order to create and organize value within these type of enterprises. The BMC analysis allows a relational approach between processes and the business purpose. According to the authors, the BMC structure has nine distinct areas: customers segment; value proposition; channels; target public relationship; sources of revenue; key activities; main resources; cost structure; and main partners. Each individual area represents part of the structural connection of the business.

2.1.1 Current Reality Tree (CRT): Cognitive Map

To Watson, Blackstone and Gardiner (2007), the CRT is one of the tools of the Theory of Constraints, and it consists of a systematic method used to identify problems arising from non-structured businesses. Costa *et al.* (2013) describe the method as being designed to support the identification of constrains, also called unwanted effects (UE), as well as the existing relation between them (WATSON; BLACKSTONE; GARDINER, 2007; COSTA et al., 2013), which is built on the effect-cause-effect logic aiming at identifying the basic causes that maintain the unwanted effects (MAIER e STIX, 2013).

2.1.2 SWOT Matrix

Chang and Huang (2006) & Lee, Huang and Teng (2009) report the SWOT Matrix analysis as being a strategic management tool for marketing assessment. According to the authors, the strategy consists in evaluating the external opportunities and threats, as well as the internal strengths and weaknesses of the organization. Thus, this tool aims at assessing whether the organization is able to seize opportunities and avoid threats in an unpredictable external environment. On the other hand, the analysis of the internal strengths and weaknesses effects ensures the appraisal of how the organization accomplishes its internal work, such as management as well as working, research, and development efficiency (CHANG e HUANG, 2006; ZHANG; CHEN, 2013).

2.2 Experimental Procedure

The experimental procedure used for data acquisition and compilation as well as tools construction and validation in the present study was structured in three experimental stages.

2.2.1 Stage I: Information Acquisition and Compilation

The required information was collected in two ways: Bibliometric Research and Exploratory Survey. The bibliometric research was also conducted by consulting the information available in databases of research institutes, and associations and government entities. The exploratory survey was used to assess the study target scenario, and to elaborate an overview regarding the activities carried out internally in the recyclable material collectors organizations. For the survey elaboration, we used semi-structured interview questionnaires previously validated. The survey contained a mix of open- and closed-ended questions, being a total of 48 questions divided into 6 main topics as shown in Table 2. The survey was conducted in nine selected legalized recyclable material collectors organizations in the MRGV, ES, Brazil.

Table 2. Summary of the information collected by the Exploratory Survey

Topics	Type of question	Example
General information	Open-ended	Name; Function; Contact details
Vision and strategy development	Closed-ended	Supporters, partnerships, search for suppliers
Development and management		Market service, milestones elaboration
Marketing and sales		Market trend analysis, target sector
Products and services delivery		Bundling strategy, production process definition
Customer service management		Post-sales activities
Discussion	Open-ended	Difficulties which disturb the organization business

Source: Own authorship.

2.2.2 Stage II: Construction of the Proposed Tools

For the construction of the BMC, the data were distributed among the nine distinct business areas. The possibility of collecting data from two complementary sources allowed the description of operation strategies regarding the actual scenario as well as the acknowledgment of the stakeholders involved in each business area of the organizations.

With the construction of the CRT, it was possible to develop the cognitive map of the dysfunctions relevant to the collectors organizations operations and activities required to the management of the unwanted effects. During the graphic construction of the CRT, the dysfunctions were identified under colours according to the classification groups, which can be listed as: purple – structural dysfunction; yellow – capacitation dysfunction; green – cultural dysfunction; blue – communication dysfunction; orange – public policies; pink – management; red – market; and grey – financial.

In the construction of the graphic model of the SWOT, which is necessary to understand the intrinsic characteristics of the business proposal of the collectors organizations, the data collected during the Stage I were described and organized under opportunities and threats of the external environment, as well as strengths and weaknesses of the internal environment.

2.2.3 Stage III: Validation of the Proposed Tools

Aiming at complementing, consolidating and validating the corporative governance tools generated (that is, BMC; CRT, and SWOT), we used the Focus Group method. In order to do that, 17 experts with direct involvement with the collectors organizations, associated collectors, and management residuals professionals were selected. Due to the heterogeneity of background and expertise of the participants, two groups were created to ensure homogeneity and to balance the discussion of the present results.

2 Results and Discussion

3.1 Perception of the significant issues to the organizations business

Aiming at understanding the composition of value and other areas which are part of the recyclable material collectors organizations business, the BMC (https://goo.gl/alIM5H) allowed, by representing the nine business areas and their respective stakeholders, to demonstrate the elements and their interactions, providing an analysis between processes and the business purpose. Notably, as stressed by Freitas and Fonseca (2011), it was identified a target-audience/customers sector known as 'middlemen', consistently observed in other Brazilian organizations as well. Tirado-Soto (2013) points out that, in the Brazilian scenario, these intermediate traders take over strategic positions in the value/suppliers chain, since trades and sales are usually made via their own actions, which cause disadvantage to the collectors organizations fundraising, as they cannot trade with the industries directly.

3.2 Identification of the operational activities and typical dysfunctions

The administration of the survey allowed the identification of the main operational activities, namely: Collect and Receive recyclable USR; Screen; Inspect for intermediate storage; Crush and Pack; Weight and Storage of recyclable screened material; Trading and Handling the delivery to the customer.

In the present study, we observed the absence of practices regarding the processing of screened materials (e.g., crushing, grinding, flocking) as reported by Tirado-Soto (2013) which has analysed the collectors organizations in Brazil. The possible explanation for this limitation is the financial difficulty to acquire specific equipment (e.g., crushers, extruders, recovers). This finding can cause a negative impact on the recyclable material selling price, since the organizations would not be able to meet certain specifications imposed by the recycling industries.

Although the operation of the collectors organizations are of paramount importance for the integrated management of the USR, they are seldom financially reciprocated by the environmental services they provide, which corroborates what has been stated by Velis et al. (2012). Therefore, one can consider a type of 'free-rider' behaviour by these authorities, as has been cited in the diagnosis by Freitas and Fonseca (2011).

The selective waste collection observed is mainly carried out by the city council cleaning companies, as also observed by Tirado-Soto (2013). This interventionist practice of the public administration enables accessibility to the dry residuals by the local collectors organizations - Velis et al. (2012).

Regarding the identification of the typical dysfunctions, mainly the ones related to the operational activities, 48 potential dysfunctions contributing to 1 main unwanted effect were detected, being the very low economic efficiency of the organizations as observed by Damásio (2010); Gerdes and Gunsilus (2010); Gunsilius *et al.* (2011). According to the consulted sources, this effect represents one of the main financial dysfunctions in the recyclable material collectors organizations business in developing countries, including Brazil (FREITAS E FONSECA, 2011). The several dysfunctions were

divided into 7 groups and share several correlations which also result in interferences in the chain value and in the establishment of the organizations in the recycling market, as shown in Table 3.
The results of the structural dysfunctions can be summarized in a list spanning from the lack of adequate equipment for the labour activity, until the absence of physical conditions for the screened recyclable material packaging. According to the consulted sources, these dysfunctions cause a negative impact on the value proposal of the organizations, since the quantity, quality, and regularity in production of the material do not meet the specifications imposed by the recycling industries/final consumers. On the other hand, these results present a connection with financial dysfunctions in cases where the organizations are not able to obtain and maintain its physical infrastructure.
The results of management dysfunction lead to the understanding that activities and personnel capacitation and coordination development are necessary to achieve an effective operational process in the delivery of products and services by the collectors organizations. Corroborating with Sembiring and Nitivattanon (2010), Freitas and Fonseca, (2011), the present study observed that problems in management of the activities employed on the internally received materials by the organizations also yielded low productivity. The 'tutelage' condition endorsed by the public sector which can also define the marketing role of the organizations poses a threat to self-management and independency. As it is an external force, rather than internal and spontaneous, the surviving of the organization is frightened if the support is withdrawn.
Under the different action paths close to the USR management system, it is possible to observe that there are challenges regarding to consolidation of initiatives, be they economic (due to the very low economic efficiency) or associative (since they hardly perform a true self-management). These dysfunctions present themselves as priorities to be solved in two fronts to be attended: pre-operational investment and capacitation.

Table 3. Typical dysfunctions related to the recyclable material collectors organizations activities.

GROUP	DYSFUNCTION
STRUCTURAL	Physical difficulties for packaging the recyclable material within the organization.
	Lack of own transportation for material collection and delivery.
	Infrastructure deficiency (warehouse, access, adequate equipment) and precarious working conditions.
CAPACITATION	Development of few activity niches.
	Inefficient market service.
	Low capacity in working with varied types of recyclable material.
	Lack of organization and planning in production activities.
	Difficulty in meeting health and safety requirements to allow access of large energy generators, which hampers the collection of the material.
	Absence of verticalization practices of the production process.
	Low technical capacity of the organizations to operationalize the management of urban solid residuals.
	Absence of representative collector members in credit managing groups.
	Lack of guidance for the collectors regarding the work in the organizations, resulting in low degree of association.
CULTURAL	Privatization of the selective waste collection.
	Low political feasibility for the establishment of the selective waste collection.
	Difficulties imposed by city councils regarding the inclusion of the collectors.
	Free-rider behaviour from the private bodies in the collectors operation.
	Lack of attendance and union by the associated members.
	Deficiency in technical assistance.
	Low credit offer/economic assistance.

GROUP	DYSFUNCTION
	Mistrust from private companies and society regarding the operation of the collectors.
	Low quality of the material generated by the city selective waste collection.
	Low participation of the organization representatives in debates relevant to business.
COMMUNICATION	Lack of integration between the collectors and the generating sources.
	Low work acceptance in market network.
	Slow diffusion of knowledge about successful practices
PUBLIC POLICIES	Low acceptance of the selective waste collection by the cities.
	Lack of direct service provision with large public and private generators.
	Poor management of financial resources allocated to the organizations.
	Low engagement of the collectors in the reversal logistics expected by sectoral agreements.
	Lack of financial reward for the environmental service provided by the collectors organizations.
	Endorsement (tutelage) of the organizations, which become depended on public administration and its partners.
	Dispute of conflicting political interests with city council.
MANAGEMENT	Lack of working capital in the collectors organizations.
	Lack of sales budget forecast.
	Prevalence of bundling strategy for product delivery.
	Few practices of service provision contracts.
	Production in low-scale, low quality and low regularity.
	Negotiation of small quantities of material.
	Difficulty in meeting the quality and quantity standard specifications imposed by the recycling industries.
MARKET	Competing companies in residuals collection.
	Oligopsony (market with a small number of buyers).
	Dependency on 'middlemen' in marketing.
	Low value in product negotiation.
FINANCIAL	Very low economic efficiency of the collectors organizations.
	Cost with transportation makes the selective waste collection unfeasible for the organization.
	Instability of earnings (survey).
	Dependency on donations for equipment and infrastructure acquisition

Source: Own authorship

The majority of collectors organizations gets started without pre-operational investment. As pointed out, they can hardly count on adequate infrastructure, such as a warehouse and all the necessary equipment for its activities. Usually, the organizations are coordinated by a chairperson who is almost always not prepared to manage the business. This is another challenge to self-management of the organization, which becomes clear as a lack of capacitation to take part in the organization decision-making process.

The cultural dysfunctions may interfere upon the way the collectors organizations operate under the USR management system, since they include the society and private companies which still present a degree of mistrust and prejudice towards the collectors. For this reason, there has been lateness from public power and formal bodies acting upon the USR management in conceiving the organizations as popular enterprises as described by Gaiger (1999). As a reflex, we can also observe the parallelism of selective waste collection operation between private companies and the collectors organizations (TIRADO-SOTO, 2013), depicting a disorder that emerges from the local culture, as seen in the recyclable material collectors organizations assessed in the present study.

Associations and cooperatives are grounded on a relationship process in which communication is fundamental for the relations developed between internal working

groups as well as for external articulation, which encompasses the dialogue with external public and private sectors. In this way, the long-term maintenance of the organizations' business also depends upon, according to Tirado-Soto (2013), a good adequacy of communication, decision-making processes, and negotiations between the associate members. Therefore, the results found in the present research concerning dysfunctions in communication may seriously interfere with the relationship with the target audience, being trading an example. We conclude that communication also works as management support, under the perspective of ensuring organization and integration between the associates and other interested parties, thus the importance to cherish the communication factor.
It can be observed that, despite the highlighted difficulties such as the business economic inefficiency, the insufficient strength to win the market, and the lack of resources to start up, these organizations are still resisting the market requirements and have begun to consider the conditions to unite. In this way, network formation emerges with the intent to eliminate the presence or even the exploitation from the 'middlemen' and, based on mutual support, they can become more competitive.

3.3 Organization of typical dysfunctions using CRT

The Current Reality Tree (CRT) was used as a systematic method in order to identify problems arising from non-structured businesses. The 58 dysfunctions identified during data acquisition were used to graphically compose the CRT cognitive map (https://goo.gl/LLFXeI), reaching the main effect at its top. The main unwanted effect was the very low economic efficiency of the Brazilian collectors organizations, as well as the organizations in developing countries, as described by Gerdes & Gunsilus (2010), and Gunsilius et al. (2011).
The interpretation of the figure makes clear that the organization of the dysfunctions allows the identification of which ones should be primarily eliminated or minimized. The dysfunctions located at the bottom of the tree are not easily perceived, but their identification and elimination could trigger a chain reaction encompassing all the consequent dysfunctions, which could lead to solving/mitigation of the main unwanted effect.
From the six unwanted root dysfunctions which have an effect over the activity of the organization, and that have been identified during the study, five belong to the cultural dysfunction group. This demonstrates that the birth of the problem concerning the activities and operations of the organizations in the recycling market overpasses the cultural heritage interface which has led the emergent of the waste collectors. In Brazil, issues from a political-social nature have arisen as preponderant factors to the foundation of these organizations, and the economic feasibility for income generation for the waste collectors has not been taken into account. Tirado-Soto (2013) refers to the necessity of a process of social and cultural formation previously to the emergence of collectors organizations. According to the author, the social capital formation seen in the fortification of the interpersonal webs would represent a possible solution to some of the cultural dysfunctions.
Regarding the structural dysfunction group depicted in the CRT, Scheinberg et al., (2006), Wilson et al. (2009), Freitas and Fonseca (2011), Chaturverdi (2011), and Tirado-Soto (2013) point to a potential solution from the creation of partnerships with both public and private bodies. However, as highlights Freitas and Fonseca (2011), such

arrangements must be drawn with cautious in order to avoid dependency on the public power and end up endorsed or tutored by it.

Although Scheinberg *et.al* (2006) and Wilson *et. al* (2009) state that the capacitation of the organization is fundamental to the potentiation of the efficiency of the activities developed for the delivery of the value proposal to the customers/target audience, Velis et al. (2012) and Tirado-Soto (2013) claim that there is not na ideal capacitation process for the internal values construction in collectors organizations. Nevertheless, it was this very same group of dysfunctions which showed the largest concentration in the CRT. The capacitation of the associate members allows not only the organization of personnel and activities, but also the self-management. Thus, the construction of capacities among other entrepreneurial and business management skills could be boosted by personal development, as training programmes for leadership and membership. Velis et al. (2012) and Tirado-Soto (2013) describe that the capacitation is related to the practical management of the organization, for instance, accountancy, dada collection, and financial management. At this point, the developments for the technical capacitation of the collectors is still an ongoing process due to the lack of independency of the organization in order to offer training courses, being conditional to external opportunities.

3.4 Intrinsic characteristics to the business proposal of the organizations

The SWOT matrix (Table 4) depicts that the areas which had the biggest information concentration were those related to the organizational weaknesses, opportunities, and threats. The opportunities present a strong relation to the fulfilment of public policies regarding the inclusion of the collectors organizations into the integrated management of the USR in Brazil.

The deterioration of the collectors organizations due to public authorities noncompliance of compulsory obligations has been pointed as a significant external threat to the development of these organizations. Velis et al. (2012) expatiate on the low effort from the competent bodies in the developing countries for the inclusion of the collectors organizations into the formal recycling system. As external threats, it can be mentioned the constant fluctuation of the recyclable material price. Due to the control exerted by the 'middlemen' traders in the recycling market, the value paid for the screened material vary according to the occasion, which makes difficult the regulation of the service as mentioned by Tirado-Soto (2013). This type of threat reinforces the need for solutions as the creation and affiliation of the organizations to marketing networks, which would strengthen the organizations when facing the challenges imposed by the recycling market.

The internal strengths presented by the organizations refer mainly to the attractiveness to individual waste collectors, corroborating to Damásio (2010). Freitas and Fonseca (2011) have verified that more than half (60%) of the assessed collectors disclosed their interest in remaining in the profession, which has been recently regulated in Brazil and confirms the productive force for the recyclable material organizations.

We also verified that the associated members show personal prospects regarding business growth and profitability. This prospect is caused by the transition phase the assessed organizations are going through, which service provision via agreements is being replaced by provision via contracts. The latter type of dealing is more secure regarding the payment for the environmental service provided and allows self-management of the internal revenue which is more convenient to the organization.

Finally, the interpretation of the weaknesses and strengths allowed the evaluation of how the organization performs its internal work. The results pointed to one-off and primary management type. One-off refers to the management practice seen in which only part of the production process is attended to. It has been observed that only the daily production is monitored, and several strategic and production processes are excluded, which reveals severe potential deficiencies in working efficiency. Primary refers to the instinctive decision-making process, which hinders the organization chairperson to develop and improve self-management within the organization.

3 Conclusions

The availability of the opportunity-generated information by the use of the Business Model Canvas for the recyclable material collectors organizations allowed the understanding of the areas and stakeholders involved, as well as how the involved parts interact under the recycling market when the organized collectors are present. The administration of the survey revealed novel information concerning the main operational activities undertaken by the organizations: material collection, solid residuals acceptance and screening, inspection, crushing, packing, weighting, storage of the screened material, and handling the delivery to the customer. We observed lack of verticalization practices of the production process. It was identified 48 typical dysfunctions, some of those acting upon these activities and distributed in the following origin groups: structural, capacitation, cultural, communication, public policies, management, market, and financial

The CRT creation allowed the visualization of the relations between the dysfunctions and the main unwanted effect, which is the very low economic efficiency of the collectors organizations. Organizing information enables management by making easier to act upon the minimization/solution of dysfunctions located at the bottom of the map (root-causes of the main effect), being the majority of cultural nature.

The strategic diagnosis of the organization business was designed using the SWOT analysis, where it was made clear that the negative aspect of both environments, external and internal, as the degradation of public policies and internal dysfunctions still overcome the strengths and opportunities of the organizations. The negative aspects impose a significant harm to the business of the organizations, although it can be noticed working effort by the associated members. The applied SWOT analysis provides the ground for the formulation of the strategy to be followed, aiming at the success, that is, to yield the expected results by the shareholders and fulfil the provisions by the other stakeholders.

All the corporative governance tools developed by the present study have been consolidated and validated under focus group, which has included the participation of the chairperson and general coordinators of the assessed organizations. This would ensure a greater commitment to the expected goal during the administration of the tools since the future entrepreneurs (associated collectors) took part of the planning process, rendering them a deeper ownership feeling towards the business.

Table 4. SWOT Matrix built on the actual circumstances of the collectors organizations in the metropolitan region of Grande Vitória (RMGV)/ES/Brazil.

INTERNAL ENVIRONMENT	**STRENGTHS** Interest in remaining in the formalized profession; Security as institutionalized/associated body; Potential agents of environmental education; Prospect regarding business growth and profitability; Potential for catchment of new partnership, suppliers and customers; Ownership feeling towards the organization; Active communication; High degree of flexibility and creativity at work; Capability of daily monitoring of the production; Capability of meeting the certification requirement of the suppliers.	**WEAKNESSES** Low to very low productivity; Slow diffusion of knowledge about successful practices; Absence of verticalization practices of the production/manufacturing process. Low technical capacity and knowledge about associations; Difficulty in meeting the quality and quantity standard specifications imposed by the customers; Precarious working conditions; Lack of working capital; Low capacity of storage of trading material; Low variety of recyclable material; Low participation of the organization representatives in debates relevant to business; Few activity niches (residuals acceptance, screening, bundling, and marketing); Dependency for equipment and infrastructure acquisition; Dispute of conflicting interests with other parts of the city solid residuals management; Lack of organization in production activities; Lack of information regarding marketing requirements; Accounting disorganization; Lack of standard size for the trading bale; Lack of own transportation for material collection and delivery.
EXTERNAL ENVIRONMENT	**OPPORTUNITIES** Incentives and opportunities stipulated by law; Expansion of the selective waste collection with the participation of the recyclable material collectors organizations; Incentive to the creation and development/capacitation of the collectors organizations; Prevision of goals for economic emancipation of the collectors; Compulsory prioritization of the collectors organizations in urban cleaning public services and in handling solid residuals; Possibility of promulgating fomenting measures and lines of funding to attend the initiatives of infrastructure implementation as well as acquisition of equipment for the collectors organizations; Possibility of setting regulations to grant tax, financial or credit incentives to projects related to responsibility on product life-cycle, primarily in collaboration with the collectors organizations; Priority of accessing the Union's resources for those cities which implemented selective waste collection with the participation of cooperative and other types of recyclable material collectors associations; Priority of participating in sectorial agreements for the recyclable material collectors organizations; Incentives to the industries to acquire secondary raw material from recyclable material collectors organizations, and the acquisition deal should be done directly with the association/cooperative; Financial benefits on the sale of recyclable material and implementation of contracts regarding environmental services provision; Accession to marketing networks; Formation of direct partnerships with recyclable materials-generating companies for the implementation of selective waste collection; Actions from the Public Attorney's Office of the Espírito Santo State to ensure the fulfilment of the Conduit Adjustment Term.	**THREATS** Non-compliance of compulsory obligations by the competent authorities; Low profit for the organization itself and for the associated workers; Low participation in the selective waste collection by the Brazilian City Councils; Management fragility of the city selective waste collection (low scale and low quality); Deficient environmental education impairing the promotion of the selective waste collection; Deterioration of public policies related to selective waste collection; Privatization of selective waste collection; Private bodies and local public authorities 'free-rider' behaviour in the collectors operation; Misapplication of financial resources granted to the collectors organizations; Mistrust from private companies and society regarding the operation of the collectors; Lack of financial reward for the environmental service provided; Deficiency in technical assistance; Recycling market controlled by 'middlemen'; Non-compliance of Agreement Terms between city councils and the State Public Attorney's Office (regulatory entity of Brazilian public policies compliance); Low value in product negotiation; Unawareness of real customers/buyers; Lack of political alignment of the Brazilian public management; Lack of public policies for granting microcredit/funding; Auctioning of the recyclable residuals.

Source: Own authorship.

The use of these tools is understood as technical support that could produce the required behaviours in the associated members, and making them the managers of their own business. The benefit from using these tools is to improve the corporative management and to create superior value to the target audience/customers of the organizations, in addition to continuous improvement which optimizes the production activities and raises the economic efficiency of the business, shaping the projects initially proposed by the waste collectors in their own organizations.

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ANALYSIS OF BARRIERS TO RECYCLABLE MARKET DEVELOPMENT WITH THE INCLUSION OF WASTE PICKERS ORGANIZATIONS FROM ESPIRITO SANTO/BRAZIL: SCENARIOS FOR APPRECIATION

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Abstract
Although recycling is a viable alternative to minimizing the impacts caused by municipal solid waste, the identification of the local recycling market is a requirement for its empowerment. This study aims to evaluate the market of recyclable solid waste in 16 cities of Brazil. Through the application of interviews, field research and secondary data collection this study observed that while relying on poor infrastructure and on Government subsidies, the 12 surveyed pickers organizations can forward 9.26% of recyclable waste to recycling with an average sorting productivity of 109 kg/picker/day and average earnings of US$ 293.40/picker/month. For the adequacy and expansion of the sorting capacity of scavengers organizations, an investment of 6 million dollars would be required, which could be compensated by the savings with the current 2 million dollars spent per year with the disposal of recyclable waste into landfills. The market for recyclable in the surveyed cities is composed mostly by micro and small enterprises, which generally conduct parallel activities.

Keywords: Recycling market; Waste pickers organizations; Solid waste; Economic analysis.

1 Introduction
Following a lengthy procedure at the Brazilian National Congress, the Federal Law 12.305/2010 was approved, enforcing the National Policy on Solid Waste Management (NPSWM). Among other obligations, the NPSWM establishes that the cities must implement selective collection systems with the participation of recyclable waste pickers cooperatives (BRASIL, 2010a). However, recyclable waste pickers cooperatives need information to maximize their profit through the appraisement of recyclable waste. According to Scheinberg, Wilson & Rodic-Wiersma (2010), Wilson et al. (2009), and Asim, Batool & Chaudhry (2012), these organizations are driven by the market and are dependent on their sales and on the city subsidies. In agreement with the authors and Cardenas (2009), the lack of knowledge on the recyclable market make them vulnerable to competition with intermediate dealings companies that profit by negotiating with the recycling industry.

Within this context, to prevent the high rate of mistaken decisions, which take an unnecessary toll on every step of recycling, this study suggests the assessment of the recyclable waste trading scenarios in 16 cities that integrate a public consortium of shared management of the region Doce Oeste of Espirito Santo state, Brazil.

1.1 Selective Waste Collection and Recycling with the participation of waste pickers in Brazil

In Brazil, most of the cities' waste management systems opt to segregate recyclable residues (dry waste) from organic residues (wet waste). Regarding recyclable residues, Brazilian cities employ a combined collection system with door-to-door picking and volunteer delivery points. In both cases, the presence of formal and informal pickers is noticed (TIRADO-SOTO & ZAMBERLAN, 2012), as well as the picking done exclusively by individual pickers and associates as observed in Abidjan/Ivory Coast (ANDRIANISA, BROU & SÉHI BI, 2016).

Typically, collected recyclable residues are directed to sorting sheds for segregation of the marketable fraction, then compressed and bundled. The rate of recycling of a given material depends on its yield, the existence of local markets, the demand for secondary raw materials, the level of governments financial and regulatory interventions, the value of primary raw materials, and the treaties related to commerce (WILSON, VELIS & CHEESEMAN, 2006). Within this economical structure, formal and informal pickers constitute the bottom of the economic pyramid, which grows in terms of earnings, but decreases in number of individuals (TIRADO-SOTO & ZAMBERLAN, 2012) (WILSON, VELIS & CHEESEMAN, 2006).

It is worth stressing that, when it comes to recyclable solid waste from selective collection, the market is often non regulated. In this market, aspects such as legal regulation, competition or production cost are not considered in the negotiation and the final product price is defined solely based on the stakeholders agreement.

Since the initial demand for secondary raw material is given by typical recycling industries, the description of this local market is of paramount importance for the determination of the expansion capability of the market. Figueiredo (2012) describes recycling as a profitable activity and notices that the Brazilian recycling industry is in development since 1990's with high recycling rates for some materials such as aluminum and cardboard.

Aspects such as value added to solid waste, the increase in number of informal pickers, scrap dealers, recycling companies and other private enterprises interested in collecting and trading recyclable residues, as well as the rise in unemployment starting in the 1990's and the implementation of Brazilian public policies were essential for the expansion in the rate of recycling and the number of pickers organizations in the country (DEMAJOROVIC, BESEN & RATHSAM, 2006). According to data from the Global Alliance of Waste Pickers (2015), these organizations are also present in about 30 countries worldwide, covering mainly Latin America, Asia and Africa.

Formalization of individual pickers into organizations, whether cooperatives or associations, tends to diminish the social vulnerability of pickers, providing them with social and economic support, while pickers working individually face a limited capacity of processing and storage and are easily exploited (WILSON, VELIS & CHEESEMAN, 2006). For Gutberlet *et al.* (2013), the formalization of pickers into organizations is also a transforming agent of human dignity, bringing social equity for those formerly living off of waste picking in landfills and the streets. Also, the less organized the entity, the lesser its capacity of adding value to recyclable waste, thus, leaving them more vulnerable to middlemen exploitation (WILSON, VELIS & CHEESEMAN, 2006).

2 Methodology

In this study, primary data were acquired through the application of surveys, interviews and field visits, in addition to secondary data obtained with the cities, states and federal institutions. The proposed scenario was produced with data relative to the generation of recyclable waste of 2013, the most recent data available when this study was conducted.

2.1 Characterization of the study area

The study area that concerns solid waste generation is delimited by the administrative boundaries of the 16 cities constituting the Public Consortium for Treatment and Adequate Disposal of Solid Waste of the Doce Oeste region of Espirito Santo, Brazil (CONDOESTE). Together, these cities summed up 372,449 inhabitants in 2013, with an area of 8,612.312 km² (IBGE, 2015).

Most of the cities in the region have already implemented the selective collection system, even if timidly or as pilot projects. Regarding the presence of pickers in the cities' recycling systems, 12 cities report they have pickers organizations in different levels of operation, implementation or formalization, while the other 4 lack any kind of pickers organization. Given that the main buyers of recyclable material are located outside our study coverage area, the data relative to recyclable material market refers to the entire state of Espirito Santo/Brazil.

2.2 Recyclable waste generation estimate

The recyclable waste generation estimate for reinsertion into the market was calculated based on typology according to Equation 1.

$$f(x) = (P_{urb.} \times f_{cov.urb.} + P_{rural} \times f_{cov.rural}) \times PC \times GC_x \times (1 - i_r) \times \frac{365}{1000} \qquad \textit{(Equation 1)}$$

where:

$f\ (x)$ = city's waste x generation in 2013 $(ton/year)$.

x = typology of estimated residue $(paper, plastic, glass\ or\ metal)$.

$P_{urb.}$ = city's urban population in 2013 $(inhabitants)$.

$f_{cov.urb.}$ = solid waste collection coverage factor on the urban area in 2013$(\%)$.

P_{rural} = city's rural population in 2013 $(inhabitants)$.

$f_{cov.rural}$ = solid waste collection coverage factor on the rural area in 2013$(\%)$

PC= generation per capita in 2013 $(kg/hab.day)$.

GC_x = gravimetric fraction of residue x $(\%)$.

i_r = rejection index in the material sorting process $(\%)$.

Total population of 2013 and urban and rural populations of 2010 for each city were obtained from the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística - IBGE) database. Since 2013 data are not segregate between urban and rural population, the percents were estimated based on IBGE's 2010 data. Values for collection coverage and generation *per capita* for each city were obtained from 2013 Diagnosis of Urban Solid Waste Management database maintained by the National System of Information on Sanitation (Sistema Nacional de Informações sobre Saneamento - SNIS).

The gravimetric fractions were determined based on the recommendation given on the Brazilian Solid Waste Plan draft, calculated from the average of gravimetric fractions found in 93 Brazilian cities between 1995 and 2008 (IPEA, 2011b). Rejection indexes were given based on interviews with pickers organized in the region studied.

2.3 *Survey* 1: Identification and Assessment of Pickers Organizations in the studied area

Data on the pickers organizations were collected through a *Survey* composed by a questionnaire that sought to assess general information, existing structure, operational costs, production processes, and amount and sales price of recyclable materials. The research was conducted between June and August of 2015, including visitations to the organizations. Eleven pickers organizations from the 12 existing in the studied cities participated in the study. The questionnaires were answered by the pickers organizations presidents or, in their absence, by a picker referred by the organization. The identified organizations were then classified into efficacy degrees according to the methodology proposed by Damásio (2010a, 2010b).

2.4 *Survey* 2: Identification of the recyclable waste market in Espirito Santo state

The identification of recyclable waste market in Espirito Santo, Brazil was carried through the cataloguing of recycling or potentially recycling companies along with environmental licensing sectors of the State Institute of Environment and Water Resources (Instituto Estadual de Meio Ambiente e Recursos Hídricos - IEMA) and with the 18 city halls in the state that also have environmental licensing. In addition to those, companies participating in recycling associations and unions and companies listed in specialized websites such as Rota da Reciclagem - http://www.rotadareciclagem.com.br and Compromisso Empresarial para Reciclagem (CEMPRE) - http://www.cempre.org.br.

Once the database is acquired, the companies were divided in two groups: recycling and potentially recycling companies. The first group comprise those companies that claim to exert recycling activities while the second group comprise companies that, although do not use recyclable waste, have the potential to do so, thus representing a potential market share. All companies were contacted via phone calls between June and September of 2015 to confirm the information in the database and to be asked to participate in the survey. The companies that agreed to participate answered *Survey* 2 through GOOGLE FORMS.

3 Results and Discussion

3.1 Recyclable waste generation and market estimates

In Brazil, the National System for Information on Sanitizing (SNIS), which gathers data provided by management bodies in the cities, whether an autarchy, department or secretariat, provides the amounts of solid waste collected but lacks real data on the amount generated. The gravimetric fractions on the Brazilian Solid Waste Plan draft (IPEA, 2011b) show 31.90% of domestic waste are recyclable, among which 13.50% are plastic, 13.10% paper, cardbord and carton, 2.90% metal and 2.40% glass.

Using Equation 1, it is possible to estimate the potential amount of domestic recyclable waste for each of the 16 cities investigated (Table 1). Although the estimate considers a scenario with 100% coverage of selective collection, which is far from the current conditions, the results indicate a large amount of recyclable waste (around 30 thousand tons per year) with economic potential being currently disposed in landfills. Zhang et. al. (2010) notice that the final disposal of recyclable waste in landfills in cities such as Singapore and Berlin is no longer accepted or is forbidden by law, as is the case of Brazil.

Survey 1 with pickers organizations allowed not only the identification of the existing organizations in the covered region but also the assessment of the existing infrastructure, human resources and costs of sorting and storage processes. Regarding infrastructure, most sheds are small (up to 300m²) and medium sized (up to 600m²), most of them with roofs. Regarding existing equipment, they do not meet the minimum amount required on the manual "Elements for Selective Collection Organization and Sorting Sheds Projects" created by the Ministry for Cities and the Environment (BRASIL, 2008). For Campos (2014), this is a recurrent deficiency of the pickers organizations in Brazil - the lack of compliance with the legal or technical requirements for infrastructure. Regarding characterization of efficiency degree of the studied organizations, typically, they are classified as low (81.82% of organizations) to medium efficacy (18.18% of organizations), characterized by formally organized groups with few equipments, little knowledge on the recycling market and in need of technical and financial support. A determining factor for this low efficacy is the lack of trust from the private companies in these organizations and the lack of technical knowledge on the recycling market, as stated by Atienza (2010), Damásio (2010b) and Chaturvedi (2011).

Although not the focus of this work, the social frailty of the pickers organizations is remarkable. Besides the strenuous physical effort of the work in the sorting sheds, the place is unhealthy and the pickers are usually not trained on safety and hygiene procedures. Castilhos Junior *et al.* (2013, p. 3115) identified a similar situation in their work with pickers in the South, South East and North East regions of Brazil. According to them, "the profession still suffers from several deficiencies, which results in marginalization, prejudice and exclusion of those who live off of it and makes the promotion of actions that contribute for their actual productive inclusion indispensible".

In their study on the recycling sector in Brazil, Campos (2014) claims that, in general, the pickers organizations are operated in precarity even in big cities that count on qualified professionals to support the organizations. However, for Asim, Batool & Chaudhry (2012), despite these socio-economic issues, pickers make a relevant contribution to the environment and economy and the global impact of their activities is positive.

The data analyzed allowed the estimate of the productivity in the sorting process for each pickers organization. The results showed that, with an average sorting productivity of 109 kg/picker/day, 91% of the organizations show productivity below the average amount suggested by Brasil (2010b) of 200kg/picker/day. This may be due to the low coverage of selective collection in the studied cities, many of which have only pilot projects (mostly restricted to schools and public departments). Damásio (2010b) explains the issue of the pickers organizations dependency with the expansion of cities' selective collection programs. According to the author, the main challenge to the pickers organizations development is to increase access to recyclable waste, in addition to the existence of middlemen and cleaning companies that are paid by tons of waste collected.

Table 1. Solid Waste Generation Estimate of the cities in the studied region in 2013.

City/ES/Brazil	Total Population in 2013	Urban Population (P_urb) in 2013	Rural Population (P_rur) in 2013	Urban Coverage Factor in 2013	Rural Coverage Factor in 2013	Generation *per capita* (kg/inhab.day) in 2013	Rejection Index	Metals (t/year)	Paper, cardboard and carton (t/year)	Total plastic (t/year)	Glass (t/year)
Data source	*IBGE (2015)*	*Adap. IBGE (2015)*	*Adap. IBGE (2015)*	*Adap. SNIS (2015)*	*Adap. SNIS (2015)*	*Adap. SNIS (2015)*	*Survey 1*	*Estimated according to Equation 1*			
Afonso Cláudio	32,551	16,600	15,951	96.39%	56.42%	1.12	30.00%	207.46	937.16	965.77	171.69
Águia Branca	10,045	3,220	6,825	98.23%	52.07%	0.79	21.25%	44.02	198.87	204.94	36.43
Alto Rio Novo	7,841	4,561	3,280	100.00%	9.12%	1.36	20.00%	55.97	252.82	260.54	46.32
Baixo Guandu	31,126	24,095	7,031	100.00%	0.00%	0.79	21.25%	157.94	713.45	735.24	130.71
Colatina	120,677	106,219	14,458	90.89%	83.47%	0.99	4.00%	1,092.62	4,935.61	5,086.31	904.23
Governador Lindenberg	11,953	4,647	7,306	100.00%	12.50%	1.28	21.25%	59.33	268.00	276.18	49.10
Itaguaçu	14,844	8,459	6,385	94.57%	78.30%	0.59	10.00%	73.07	330.06	340.13	60.47
Itarana	11,349	4,271	7,078	98.23%	52.07%	0.79	20.00%	52.48	237.05	244.29	43.43
Laranja da Terra	11,418	3,721	7,697	100.00%	40.78%	0.58	21.25%	33.17	149.82	154.39	27.45
Mantenópolis	14,808	9,407	5,401	100.00%	100.00%	0.24	21.25%	29.62	133.82	137.90	24.52
Marilândia	12,092	6,149	5,943	100.00%	59.31%	0.63	30.00%	45.16	203.99	210.22	37.37
Pancas	23,125	10,838	12,287	96.88%	12.21%	0.74	20.00%	75.20	339.68	350.05	62.23
São Domingos do Norte	8,595	3,692	4,903	98.23%	52.07%	0.79	20.00%	41.15	185.88	191.55	34.05
São Gabriel da Palha	35,232	26,900	8,332	100.00%	100.00%	0.70	20.00%	208.84	943.40	972.20	172.84
São Roque do Canaã	12,179	6,033	6,146	100.00%	72.68%	0.42	21.25%	36.76	166.05	171.12	30.42
Vila Valério	14,614	5,328	9,286	98.23%	52.07%	0.79	21.25%	66.00	298.12	307.22	54.62
CONDOESTE	***372,449***	***244,139***	***128,310***	-	-	-	-	***2,278.77***	***10,293.76***	***10,608.07***	***1,885.88***

Source: Own authorship.

Survey 1 also showed that some organizations receive waste from companies and commerce making them a second source of raw material. The calculated index of deviation of the destination pathway of the recyclable dry fraction of municipal solid waste (MSW) for the study is 9.26% in mass. This low value highlights the non used economic potential by the cities. With data from Survey 1, the monthly operational cost was calculated as of the order of US$ 4,600.00 per pickers organization (around 66% spent only in rent and equipments maintenance), a cost that is divided between the city hall and the organization. In general, the city hall pays the highest cost (rent and equipment maintenance). It also showed that the participation paid per picker in the cities studied varies from US$ 62.00 to US$ 500.00/month (average of US$ 293.40/month), where the highest payments are made to pickers hired as city servants or are paid for environmental services as a subsidy. For Wilson, Velis & Cheeseman (2006) this low compensation is due to their low position in the recycling market hierarchy.

From the estimate of recyclable waste generation it was possible to infer the minimum infrastructure in terms of sheds and equipments to be purchased due to the expansion of collection and the costs resulting from this investment (Table 2). The numbers suggest an investment of approximately 6 million dollars to adequate the current infrastructure of the sorting sheds and acquisition of equipments. However, based on data from SEDURB (2014), we notice that the cities studied spend over 2 million dollars yearly with the collection and dumping of recyclable waste. Thus, the expansion of selective collection and destination of the recyclable dry fraction to recycling could compensate part of these investments. Also, the setting up and adequacy of the sorting sheds can be seen as an investment that will bring medium and long-term savings to the city, as highlighted by Tirado-Soto & Zamberlan (2013) and Campos (2014).

The investment in the pickers organizations would also increase the number of job openings, income generation and new business possibilities, and would allow the reverse logistics of waste (TIRADO-SOTO & ZAMBERLAN, 2013; BARR, *et al.*, 2013). This work identified 549 new job openings with the mentioned investments in infrastructure and expansion of selective collection, allowing the assimilation of informal pickers that live off of waste picking in the streets.

Regarding sales price of recyclable waste, it was shown that it is determined both by the supply and demand and by specific aspects of this enterprise. For instance, the bundle size is an aspect that affects the sales price in the sense that organizations that use presses with larger compression strength and allow larger bundles get better prices. Another aspect that influences sales price is the quality of the sorted material, which varies from organization to organization, with better prices for better sorted materials. On top of that, there is a deficiency in negotiation of the pickers organizations. Most of the time, the prices are negotiated with the customers without a real evaluation of the effort required on the sorting of that material. This dysfunction was also noticed by SUTHAR, RAYAL & AHADA (2016) in India.

Table 2. Costs of adequacy/setting up of a minimum infrastructure.

City/ES/Brazil	Amount of recyclable waste estimated (kg/day)	m² shed required	m² shed existing	m² shed to be built	# of sheds to be set up	Cost of setting up the remaining sheds	Collective equipments to be purchased	Cost for purchasing the collective equipments	Cost for purchasing individual equipments	Total cost of setting up sheds and equipments
Afonso Cláudio	6,252.29	1,875.69	350.00	1,525.69	2GG	US$ 647,591.14	3P/1B/4C/2E	US$ 21,241.60	US$ 1,618.89	US$ 670,451.63
Águia Branca	1,326.75	398.03	N/A	398.03	1GM	US$ 161,897.79	1P/1B/1C/1E	US$ 8,264.71	US$ 305.36	US$ 170,467.86
Alto Rio Novo	1,686.70	506.01	200.00	306.01	1GM	US$ 161,897.79	1P/1B/1C/1E	US$ 8,264.71	US$ 378.98	US$ 170,541.48
Baixo Guandu	4,759.84	1,427.95	200.00	1,227.95	1GP/1GG	US$ 404,744.46	1P/2C/1E	US$ 7,113.75	US$ 1,095.52	US$ 412,953.74
Colatina	32,928.13	9,878.44	200.00	9,678.44	1GP/8GG	US$ 2,671,313.46	15P/8B/16C/8E	US$ 107,214.88	US$ 7,398.61	US$ 2,785,926.95
Governador Lindenberg	1,787.98	536.39	N/A	536.39	1GM	US$ 161,897.79	1P/1B/1C/1E	US$ 8,264.71	US$ 411.52	US$ 170,574.02
Itaguaçu	2,201.99	660.60	400.00	260.60	1GP	US$ 80,948.89	N/A	N/A	US$ 494.77	US$ 81,443.66
Itarana	1,581.47	474.44	600.00	0.00	N/A	N/A	1E	US$ 1,195.36	US$ 355.34	US$ 1,550.70
Laranja da Terra	999.51	299.85	N/A	299.85	1GM	US$ 161,897.79	1P/1B/1C/1E	US$ 8,264.71	US$ 230.05	US$ 170,392.54
Mantenópolis	892.77	267.83	400.00	0.00	N/A	N/A	1P/1B/1C/1E	US$ 8,264.71	US$ 205.48	US$ 8,470.19
Marilândia	1,360.91	408.27	300.00	108.27	1GP	US$ 80,948.89	1B/1C	US$ 1,261.49	US$ 305.78	US$ 82,516.16
Pancas	2,266.19	679.86	260.00	419.86	1GM	US$ 161,897.79	1B/1C/1E	US$ 2,456.84	US$ 509.19	US$ 164,863.82
São Domingos do Norte	1,240.08	372.03	700.00	0.00	N/A	N/A	1P/2C/1E	US$ 7,113.75	US$ 278.63	US$ 7,392.39
São Gabriel da Palha	6,293.91	1,888.17	400.00	1,488.17	1GM/1GG	US$ 485,693.36	1P/1B/2C/1E	US$ 8,319.98	US$ 1,414.18	US$ 495,427.51
São Roque do Canaã	1,107.82	332.35	N/A	332.35	1GM	US$ 161,897.79	1P/1B/1C/1E	US$ 8,264.71	US$ 254.97	US$ 170,417.47
Vila Valério	1,988.93	596.68	N/A	596.68	1GG	US$ 323,795.57	2P/1B/2C/1E	US$ 14,127.84	US$ 457.77	US$ 338,381.18

City/ES/Brazil	Amount of recyclable waste estimated (kg/day)	m² shed required	m² shed existing	m² shed to be built	# of sheds to be set up	Cost of setting up the remaining sheds	Collective equipments to be purchased	Cost for purchasing the collective equipments	Cost for purchasing individual equipments	Total cost of setting up sheds and equipments
Total	***68,675.29***	***20,602.59***	***4,010.00***	***17,178.29***	***4GP/7GM/13GG***	***US$ 566,757.82***	***29P/19B/36C/22E***	***US$ 219,633.76***	***US$ 15,715.03***	***US$ 5,901,771.29***

P – Press / B – Scale / C – Cart / E – Forklift / N/A – Not applicable.
GP (Small shed) - 300 m² / GM (Medium shed) - 600 m² / GG (Big shed) - 1.200 m².
US$ 1 = R$ 3.2208
Source: Own authorship.

Finally, this work showed that, although the prices charged at the pickers organizations in the studied region are close to the national market, they are, most of the time, below the national average. One reason for that is the lack of big recycling companies that could foster the market by increasing the demand for waste as indicated by the Interamerican Association of Sanitary and Environmental Engineering (Associação Interamericana de Engenheira Sanitária e Ambiental - AIDIS, 2006). When the companies are far from the generation areas, the freight cost pushes the prices down or makes selective collection impractical. Another reason for the low prices is the organizations' lack of negotiation skills when dealing with buyers that are mostly middlemen who sell for the recycling industries for higher prices. According to Souza, Paula & Pinto (2012, p. 259) "the dependency on middlemen is suggested in the literature as the biggest obstacle in the ascension of pickers in the recycling value chain" and the organization and training of pickers are an effective way to circumvent this situation (Haan, Coad & Lardinois[1], 1998 *apud* Wilson, Velis & Cheeseman, 2006).

3.3 Recyclable waste market in the state of Espirito Santo, Brazil

The survey on recycling and potentially recycling companies in the state of Espirito Santo/Brazil identified 150 companies settled in 33 cities. The main ones are Cariacica (34), Vila Velha (27), Serra (19) and Linhares (16). Only the cities that constitute the metropolitan region of Vitoria/ES/Brazil hold 87 recycling companies, representing 58% of the total number, while in the region studied only 4 companies were identified. Regarding the potentially recycling companies, 85 were identified, among which only 1 is in the studied region.

Although all the companies had been asked to participate in the study, only 29 answered the questionnaire. This may be a reflex of the low interest in developing/describing the local recycling market. When asked about their recyclable waste suppliers, the companies replied in decreasing relevance order: other industries, commerce, junk yards, pickers organizations, individual non formalized pickers, and others.

When asked about the existence of barriers for the direct purchase from the pickers organizations, the companies claimed that the organizations prefer to negotiate directly with the middlemen. These are more capable and more reliable, delivering higher quality products, as corroborated by Souza, Paula & Pinto (2012) and Wilson, Velis & Cheeseman (2006). Regarding the pickers organizations studied, they also prefer the negotiation through middlemen since, even though they pay lower prices, they buy their whole weekly production. Also, when asked about their interest in starting to use a recyclable waste in their production process within 10 years, 44% of the companies showed interest in at least one recyclable waste typology.

This work also estimate the amount of resources lost with the disposal of recyclable waste with economic potential in landfills. Results suggest that the studied organizations could jump from the current US$ 62,343.89/month to US$ 547,142.06/month, which would be translated into a nearly 800% increase in revenues. This could easily guarantee the organizations independence from the cities subsidies for maintenance. This revenue, as well as tax subsidies (both to pickers and recycling industries) are essential to minimize the environmental impacts caused by the inappropriate disposal of solid waste, in addition to the promotion of recycling, as agreed by Chen; Geng; Fujita(2010) and Matter *et. al.* (2015) who worked in China and Bangladesh, respectively. However, institutional weakness and the lack of cooperation

[1] Haan, H. C., Coad, A., Lardinois, I. (1998). **Municipal waste management: Involving micro-and-small enterprises.** Guidelines for municipal managers. Turin, Italy: International Training Centre of the ILO, SKAT, WASTE.

between stakeholders (government, organizations and community) for the implementation of public policies were observed, in agreement with the findings by Dos Muchangos, Tokai & Hanashima (2015) in Maputo, capital and biggest city of Mozambique.

4 Conclusions

The estimate for recyclable waste generation based on official data and on the data produced by the study with 12 pickers organizations for the cities covered is 92 thousand tons of urban solid waste per year, from which around 30 thousand tons are relative to recyclable waste. For the adequacy of the current structure, considering the expansion of selective collection coverage, we estimate an investment of nearly 6 million dollars, which correspond to the setting up of 13 big sheds (1,200 m²), 7 medium sheds (600 m²) and 4 small sheds (300 m²), in addition to 29 compacting presses, 19 scales, 36 carts and 22 forklifts. We also estimate the generation of 549 job openings in the pickers organizations to meet the requirements of the proposed scenario, contrasting with the current 93 cooperative members currently formalized.

All the assessed pickers organizations are formalized in regular associations. Although counting on a precarious infrastructure and dependent on public subsidies, they are able to forward 9.26% of the recyclable waste provided by selective collection to recycling, with an average sorting productivity of 109 kg/picker/day and average participation of US$ 293.40/picker/month and average operation cost of around US$ 4,600.00/month per organization. According to the classification suggested by Damásio (2010a, 2010b), approximately 17% of the assessed organizations have medium efficacy, while 82% have low efficacy. As a reflex, their sales price are, most of the time, below the national average. One reason for it may be the organizations' lack of negotiation skills, leading them to negotiate with middlemen.

Regarding the identification of the consumer market, from the 150 recycling companies identified in the state of Estado do Espírito Santo, only four are located in the region studied. From the 85 potentially recycling companies identified, only one is located in the region. This low capacity for demand of the local market leads to the devaluation of the products generated in the region due to the cost of freight to other cities or states. Thus, the incentive to the setting up of recycling companies in the region will help the development of the recycling market and the sales of waste generated locally.

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