

OPERATIONAL ACTIVITIES FOR WASTE PICKER ORGANIZATIONS: PRIORITY MATRIX

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Abstract

With the sanction of the Brazilian National Solid Waste Policy, the Waste Picker Organizations (WPO) have been formally incorporated into solid waste management. However, due to the social and economic situation of waste pickers, the WPO have inefficiently performed their Operating Activities of the Recycling Chain (OARC) because of dysfunctions in various areas of the business. In order for WPO to strategically position themselves in the recycling market by networking, they need to have a standardized production language. Thus, the objective was to propose the hierarchical organization of OARC according to Criteria that Influence Market Efficiency (CIME). The methodology used bibliographic research and consulted 80 Brazilian specialists for CIME validation. An exploratory survey, multicriteria analysis of the Analytic Hierarchy Process was used for prioritization of OARC and Focus Group meetings in 6 regions of Espírito Santo with 124 representatives of WPO and public authorities. CIME has been identified as "Ability to receive and process urban solid waste with recyclable potential", "Ease of execution of production steps", "Ability to compete in the market", "Being self-managed and organized", "Support from the Government and development agencies", and "Ability to add value to the product", listed in descending order of importance. The TOP3 criteria are directly related to the infrastructure, equipment, and self-management of the business. The activities of "Planning and aligning supply chain resources", "Acquiring raw material", and "Planning and managing client service operations" were among the top 10 OARC (TOP10) with the highest degree of importance for all studied regions.

Keywords: recyclable material picker organizations, operational activities, recycling chain, Analytic Hierarchy Process, Criteria that Influence Market Efficiency.

1. Introduction

Tirado-Soto & Zamberlan [1] and Ferri, Chaves, & Ribeiro [2] affirmed that the participation of the Waste Picker Organizations (WPO) in the integrated management of solid waste (IMSW) has been promoted through subsidies and assistance programs and are dependent on the public sector as the main economic source. This dependence must be reduced and/or eliminated so that WPOs have autonomy in their projects because waste pickers have a tactical knowledge and play an important role in the recycling chain [1, 3]. However, the survival of WPOs is often only possible when there is support from outside organizations [4].

According to Besen & Fracalanza [5] and Navarrete-Hernandez & Navarrete-Hernandez [6], the sustainability of WPOs relies on their ability to carry out these activities with guarantee of institutional standardization, self-management, and the generation of work and income under adequate public health and safety conditions in order to achieve increasing social, economic, and environmental results.

In this sense, the activities of the WPO have been the subject of academic research, which in brief has the objective of indicating methods to broaden the performance of the WPOs and improve their position in the market [8, 9]. The agreed recommendations to improve the efficiency of WPOs and achieve gains in scale and quality are: inclusion of WPOs in integrated solid waste management and reverse logistics, training for self-management of the business, standardization of production, analysis of the recycling market, use of accumulation sites for waste with recyclable potential, and the formation of commercial networks [1,2,4,7,9,10,11,12].

In this sense, Damásio et al. [11] argued that the concept of market efficiency for WPO, which deals with the capacity to obtain the best market price for the same quantities of Urban Solid Waste with Recyclable Potential (USWRP), is the ratio of economic efficiency to physical efficiency: average gross return (R\$/month/waste picker) divided by the average productivity (kg/month/waste picker). Therefore, any criterion that interferes with physical or economic efficiency will also alter market efficiency, i.e., the capacity of WPOs to put their products in the most advantageous situation in the market [11]. This means that greater market efficiency of the WPO improves the value obtained for the products and services offered by the WPO.

According to Garcia [12], the creation of commercial networks for the WPOs in the current market environment, as well as in the projection for the next 20 years, proved to be viable from the economic point of view. The study also showed that the formation of a commercial network in Espírito Santo, Brazil, will be able to supply the recyclable market demand and capable of generating US\$1.25 to US\$11.50 million per year.

The Operating Activities of the Recycling Chain (OARC) of the Recyclable Material Picker Organizations (WPO) are non-standardized, disorganized, have rudimentary practices, and lack knowledge on the relationship between them and their respective importance [4, 13]. These factors create an unfavorable environment for WPOs in the market [9, 13].

Thus, there is a need to know, identify, and standardize the OARCs performed by the WPOs in a Structure of Operational Activities (SOA) in such a way that provides conditions to improve business self-

management and economic efficiency, eliminate or reduce dysfunctions, and facilitate work in network formats [13].

Among the benefits of adopting a Structure of Operational Activities for WPO is the standardization and organization of activities, the achievement of advances in the marketing structure, the increase of competitiveness in the recycling market, and the broad knowledge of all the former [14]. In this paper, an overview of the activities carried out is presented, serving as a relevant tool for knowledge transfer in typical business activities.

Organizations can adapt SOA to their reality, taking advantage of best practices, as a useful tool for standardizing the activities of WPO and for forming commercial networks, allowing for communication between different WPOs with a standard language. According to Dijkman, La Rosa & Reijers [15], the use of an SOA allows for understanding and managing how processes are interconnected and how they generate value within organizations. Therefore, the organization of the business becomes a tool for the WPO to improve the value proposition to the client so that they become more efficient and have a more economically valued position in the recycling market.

In view of the above, the present research aimed to rank the OARC of the WPO of Espírito Santo State, Brazil, according to Criteria that Influence Market Efficiency (CIME). This was done in order to propose a priority matrix for actions related to the standardization and organization of OARC that allows for creation of Structure of Operational Activities.

2. Material and methods

2.1. Study area

The study was conducted in the state of Espírito Santo (ES), Brazil, which has 65 WPO in operation, distributed in 59 of the 78 municipalities. These areas are divided into 6 regions, as shown in Fig.1.

Figure 1 – Location of Recyclable Material Picker Organizations in the Espírito Santo State, Brazil.

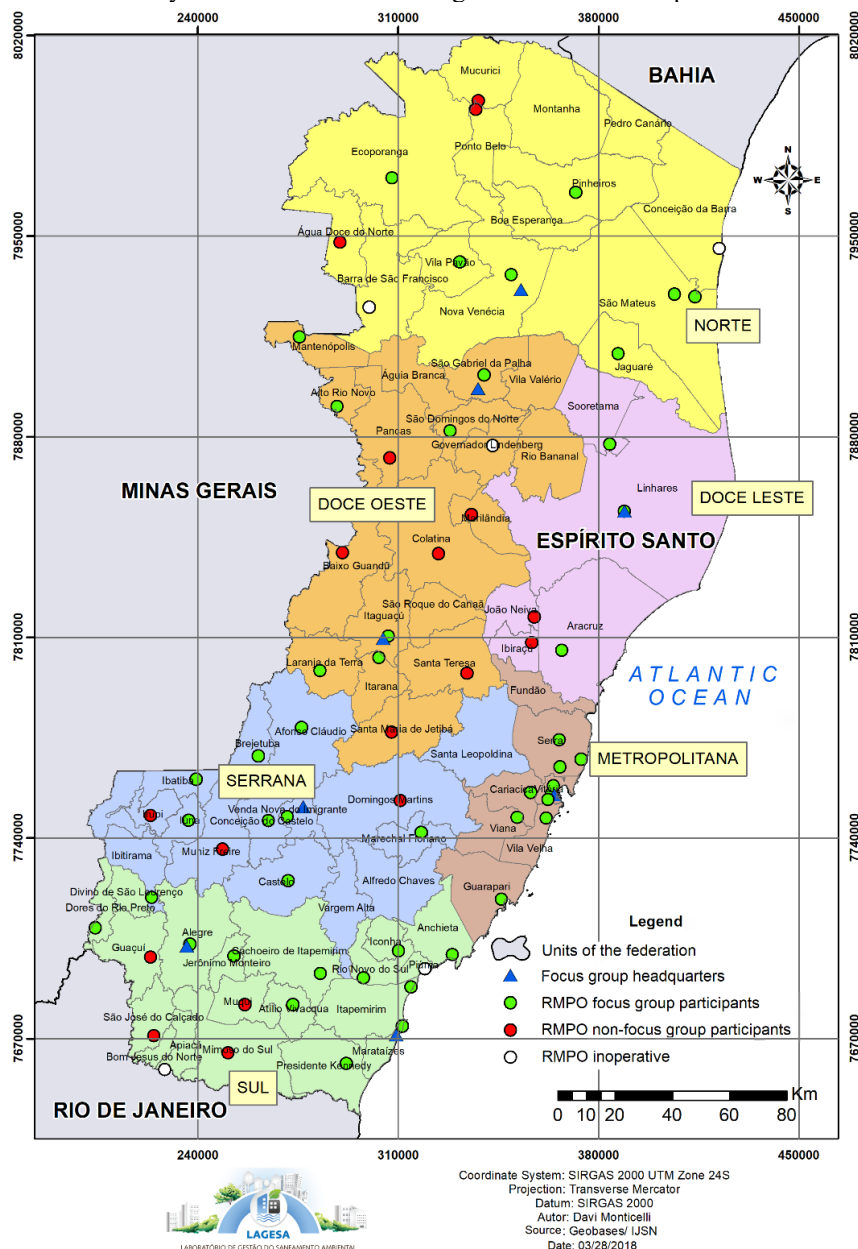


Fig. 1 shows the distribution of operational WPOs distributed throughout the six microregions, and those selected for the research were classified as "in operation", whether or not they participated in the application of a focal group methodology.

2.1.1. Characterization of study area

At the national level, the Southeastern region of Brazil, where State of Espírito Santo (ES) is located, had 41.6% of Brazilian waste pickers when compiling the research presented by the Institute of Applied Economic Research (Instituto de Pesquisa Econômica Aplicada, IPEA) [16]. The number of waste pickers per WPO in ES presents an average of 10 ± 5 waste picker/WPO and are characterized by preponderance

of female workers. In the scenario of Espírito Santo, the Southern region of the ES stands out with the highest number of WPOs, followed by the Doce Oeste, Serrana, Norte, Metropolitana, and finally, Doce Leste regions.

Regarding the contract or agreement for municipal public support, 36 of the 65 of the WPO maintain this type of relationship, which in fact has been necessary for them to remain in the market. The public power generally participates by sending USWRP to the WPO, as well as paying for water, electricity, or rent, in addition to granting space or equipment to carry out the activities [1, 4].

As for the USWRP collection activity, only 6% of the contracts established for this service in Espírito Santo are made by WPOs. For other cases, the USWRP arrives at the WPO screening shed after delivery by the municipality. The main sources of USWRP are the municipal selective collection, local market, companies, and conventional collection. In the case of the conventional collection, it is noted that 3 of WPOs receive mixed (or contaminated) solid waste that generates a high percentage of tailings.

The predominant form of commercialization in the ES is bales, but there are also WPOs that sell product in bags (6%), and others make bales manually, even without having press. The WPO sales cycle is monthly, being directed to intermediaries. According to sales history, WPOs have sales forecasts, but there is no control or even goals to be achieved.

The characterization of this study area demonstrated that WPOs from Espírito Santo need a structure for operational activities, defined in order to improve the competitiveness in the state recycling market.

2.2. Methodology

The methodology was developed in three stages as detailed in Tab. 1.

Table 1 – Methodology stages

Stages	Methods	Obtained results
Stage 1 - Identify, select, and prioritize CIME of the WPO	- Bibliographic research - Exploratory survey of 80 Brazilian specialists	CIME selected and prioritized
Stage 2 - Check the execution status of the OARC and classify its execution (projects, process, or operation)	- Documental research - Survey	Status of execution and classification of OACRs
Stage 3 - Consolidate the WPO collective judgment matrices to consider and prioritize their OARC.	- Focus Group (FG) in six regions of Espírito Santo with 124 representatives of WPO and government - Multicriteria analysis - Analytical Hierarchy Process (AHP)	OACRs priorities

2.2.1. Stage 1 - Identify, select, and prioritize CIME of the WPO

From the bibliographic research of WPO dysfunctions [13], 11 Influencing Criteria in Market Efficiency were identified, being:

- “Quality of life”: related to the health and safety at work of the WPO.
- “Representation and inclusion of WPO in the region”: refers to the inclusion of WPO in municipal activities, such as representation of WPOs in municipal meetings pertinent to the business.
- “Compliance with legal requirements”: makes reference to the legal aspects for compliance of the WPO, as for example, the environmental licensing, contracts/agreement.
- “Assistance”: refers to the dependency of the WPOs of the government, partners, and the intermediaries.
- “Support from the government and development agencies”: different from “Assistance”, government support and entities refer to the development of actions that provide conditions for WPO to have better conditions for the performance of the activity. Example: Remuneration for the services rendered to the municipality.
- “Being self-managed and organized”: refers to the structuring of the organization to carry out the activity (association or cooperative), especially with respect to close participation of the waste pickers for WPO to develop.
- “Ability to compete in the market”: defined as the ability to obtain and maintain new clients, develop niche business, identify market demand, and acquire financial resources and incentives.
- “Ability to add value to the product”: related to the way in which the production stages of segregating, screening, baling, storing, and shipping are carried out in order to meet the requirements of the market in terms of quantity, quality, and frequency.
- “Ease of execution of production steps”: making production easier to execute, including tasks such as planning and organizing production steps, having appropriate equipment, and redesigning layout with site utilization.
- “Clients satisfaction”: refers to return of clients and attendance of requests and complaints.
- “Ability to receive and process USWRP”: is related to the infrastructure (shed), number of waste pickers and hours of work to process the USWRP, and expectation to increase the amount of material.

71% of the total WPOs of the ES participated in the survey. Regarding the number of waste pickers and representatives of the government that totaled 124 participants, 78% were waste pickers.

Following the recommendation of Russo & Camanho [17] for the application of the Analytical Hierarchy Process (AHP), the six most relevant criteria were selected with regard to the improvement of market efficiency for the WPO investigated.

The Analytic Hierarchy Process (AHP) was chosen because it is a multi-criteria decision support method that is easy to use in relation to other methods and is therefore the most used in academic and business environments to solve complex (quali-quantitative) problems and decisions. The objective of the AHP was to provide an order of priority for the OARC, aiming at actions that would enhance the market efficiency of the WPOs.

The CIME were evaluated in order to obtain weight for each criterion in relation to the objective of the AHP through the pair-by-pair combination. Therefore, each participant evaluated how important one CIME is in relation to the other to maximize achievement of the goal. The weight (importance) of each criterion is obtained from the priority vector or eigenvector. All pair-by-pair combinations and the calculation of priorities (eigenvectors) were performed for each individual and through the geometric mean, obtaining the aggregation of priorities [18].

2.2.2. Stage 2 - Check the execution status of the OARC and classify its execution (projects, process, or operation)

For the identification of the OARC carried out in the WPO of Espírito Santo, Brazil, documentary research was carried out that selected 74 OARC. A survey was applied in order to verify the execution status of the selected OARC ("fully performed", "partially performed", or "unperformed") and the way the waste pickers perceive that the activity should be carried out, such as project, process, or operation.

The "fully performed" activity is described as being executed to greater degrees of organization and frequency at work, which does not mean that the activity cannot be improved. When it is classified as "partially performed", it is noticed that the activities have initiatives or some actions related to them. In the case of those classified as "unperformed", it was noticed that they did not present any initiative related to them.

The survey was elaborated in six blocks:

- Block 1: Develop Vision and strategy

Consisting of activities that involve the definition of business and long-term vision, development of

business strategy, and management of strategic initiatives.

- Block 2: Develop and manage products and services

Involves activities related to product/service portfolio management and the development of new products/services.

- Block 3: Market and sell products and services

Includes activities of understanding the market, client, capacity of organizations, development and management of marketing, and sales strategy. This block describes activities that bring direct financial return to WPO.

- Block 4: Deliver products

Includes activities of planning and aligning supply chain resources, acquiring raw materials, delivering product to the client, and managing logistics. With regard to products, to meet the needs of each segment of the target public, the WPOs aim to deliver the following products as a value proposition (product and service portfolio): solid waste sorted; recycled materials; and secondary raw materials (TACKLA, 2016).

- Block 5: Deliver services

Includes activities to establish governance and service delivery strategies, manage service delivery capabilities, and deliver client service.

- Block 6: Manage client service

Includes activities to develop client service and care strategy, plan and manage client service operations, and measure client satisfaction. Tackla, Baldam, & Siman [13] described that WPOs attract and maintain clients through online and/or telephone contact and attendance at events. This way of communication and relationship to reach the target audience is realized through their own sales team, search of new clients in the internet environment, and sales by phone.

Through the survey, 80 active experts in Brazil were consulted with activities inherent to the research to rank the 11 Influencing Criteria in the Market Efficiency of the WPO from Espírito Santo. The application of the questionnaire at the national level had representatives from the states: Bahia, Distrito Federal, Goiás, Espírito Santo, Minas Gerais, Paraíba, Paraná, Pernambuco, Rio de Janeiro, Rio Grande do Norte, Rio Grande do Sul, Santa Catarina, and São Paulo.

In order to evaluate the relative importance of each CIME (selected in Stage 1) and the importance of the OARC (selected in Stage 2) in relation to the CIME, Stage 3 collective judgment matrices were elaborated.

2.2.3. Stage 3 - Consolidate the WPO collective judgment matrices to prioritize their OARC

In the survey carried out in Stage 2, 74 OARCs were listed, which were classified as processes. For the judgment matrices, 21 OACRs were selected for evaluation according to the CIME by block of activities, obtaining a total of 30 combinations.

With the collective judgment matrices defined, the eigenvector and the overall OARC evaluation for hierarchy were calculated. The OARC were ranked in descending order according to the importance of the overall evaluation. A higher value for the overall assessment resulted in greater importance given to an OARC, indicating priority of actions directed to it. A statistical analysis of the occurrence frequency for the 10 most important state-level OARCs (called TOP10), among the 10 OARCs with the highest importance in the regions, was performed to analyze the hierarchy of the OARC of the ES regions.

The consolidation of the judgment matrices was performed through focus group (FG) meetings in the six ES regions (Fig. 1). In the FG meetings, there was participation by waste pickers and representatives of the government, as well as researchers and representatives from other sectors, which enabled interaction, dialogue, and judgment among the members with different perspectives.

The group of survey participants in the FG meetings was stratified into the following groups: 42% researchers, 27% representatives of government, 23% representatives of WPO, and 8% companies and consultants who have performed some activity in the WPO. As for the level of education, only 10% had up to the vocational level, 60% had a university degree, 6% specialization, 8% master's degree, and 16% doctorate degree. The ages ranged from 20 to 80 years with 44% between 20 and 40 years, 43% between 41 and 60 years, and 11% between 61 and 80 years of age.

For the categorization, an express scale was adopted for the participants in a logical increasing line, using numbers from 1 to 9, where the value 1 meant less importance, 5 equal importance, and 9 greater importance.

3. Results and discussion

3.1. Stage 1 - Identify, select, and prioritize CIME of the WPO

Tab. 2 shows the classification of the Criteria that Influence Market Efficiency evaluated in descending order of the weights obtained.

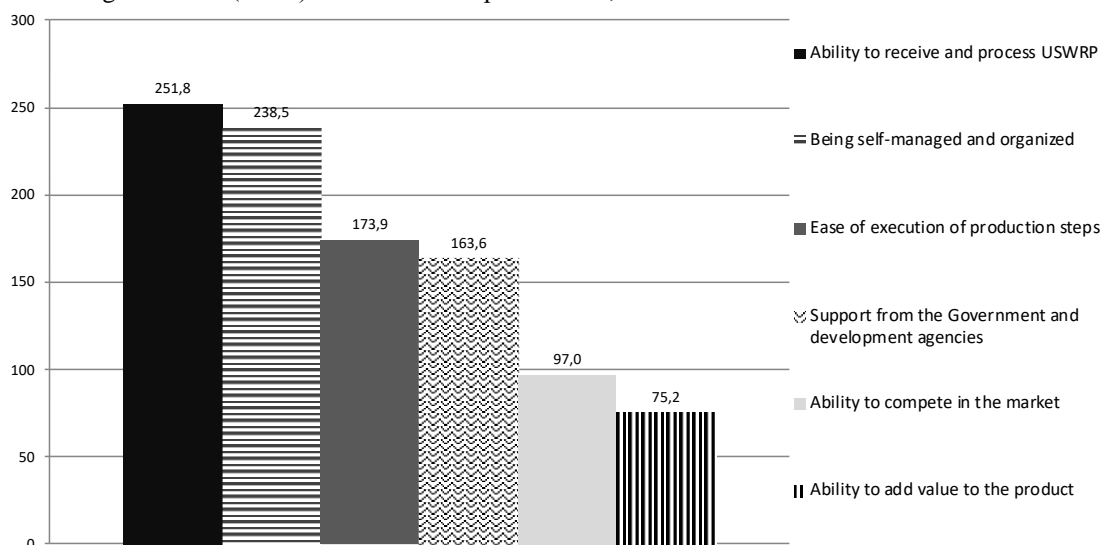
Table 2 – Weights obtained in the evaluation of Criteria that Influence Market Efficiency (CIME)

	CIME	Weight
CIME 1	Ability to add value to the product	4.60
CIME 2	Support from the Government and development agencies	4.53
CIME 3	Being self-managed and organized	4.49
CIME 4	Ability to compete in the market	4.48
CIME 5	Ease of execution of production steps	4.43
CIME 6	Ability to receive and process USWRP	4.41
CIME 7	Representation and inclusion of WPO in the region	4.40
CIME 8	Client satisfaction	4.35
CIME 9	Compliance with legal requirements	3.83
CIME 10	Quality of life	3.81
CIME 11	Assistance	3.56

Legend: USWRP: Urban Solid Waste with Recyclable Potential; WPO: Recyclable Material Picker Organizations.

Although the first six CIMEs for the hierarchy of the OARCs were selected as shown in Table 2, they were evaluated with a very close level of importance, evidencing the need for action in all areas.

From the CIME classification to the national scenario, they were evaluated by pair-by-pair combination to obtain the priority eigenvector for the state of Espírito Santo. Fig. 2 shows the order of priority of the CIME from ES.

Figure 2 – Eigen vector to Criteria that Influence Market Efficiency (CIME) of the Recyclable Material Picker Organizations (WPO) from state of Espírito Santo, Brazil.

It is observed that the CIME related to the infrastructure and equipment are in first and third place in the hierarchy shown in Fig.2. This demonstrates the importance given by the WPO to this factor and corroborates the Brazilian scenario regarding the need to have the minimum equipment and adequate infrastructure for the performance of the OARC. Tirado-Soto & Zamberlan [1] and Tackla, Baldam, & Siman [13] affirm that the deficiency of WPOs in these issues directly affects the development of OARC.

According to the authors, such dysfunctions are related, for example, to the difficulties of packaging the USWRP, less power to add value to the recyclable material, lack of owned transport vehicles for collection and delivery of recyclable material, and low storage capacity for commercialization.

In the State of Espírito Santo, the WPO scenario is not different from national Brazilian scenario, since these do not have minimum requirements established by Brazil [19], despite investments by public authorities and development institutions. As described in the study area characterization, only 29% of the 65 WPO have a press, scale, and sorting table, and 43% still carry out sorting on the floor. WPOs are weakened in terms of equipment and workplace organization, so productivity and execution of OARC are affected by the following failures: rework; daily reorganizations; lack of definition and identification of the sectors (reception, sorting, pressing, storage, etc.); inefficient disposal of equipment; lack of logical sequence of the production process, which increases unnecessary work in storage and sorting sheds; poor distribution of types of activity by physical competence (example: elderly performing heavy activities); and structural points that potentiate accident events (floor differences, narrow doors).

In relation to the sorting and storage sheds, they are mostly classified as small (up to 300 m²) and medium sized (up to 600 m²). In addition, it should be noted that when the sheds are not in the possession of the city hall, the rental costs are incurred by the WPO [4].

In this way, the importance given to the criteria "Ability to receive and process USWRP" and "Ease of execution of production steps" emphasizes the recurrent deficiency in the WPO, lack of compliance with legal or technical infrastructure requirements, as well as evidences that the waste pickers see the need for adequate infrastructure and essential equipment for OARC performance [20].

Regarding "Being self-managed and organized", the second most important CIME in this research, it was noticed that waste pickers identify the need to be organized for the WPO to get support from the government. Corroborating this information, 90.5% of the 215 waste pickers of 34 WPOs in ES approached in the survey of Guimarães [21] highlighted advantages for organized labor. The research points out the following as advantages: better conditions for activity, regularity of income, having work routine, and liking the environment and work group.

Also, regarding the question of self-management, the authors IPEA [16], Gutberlet [3], and Ghisolfi et al. [22] also noted that the formalization of work in WPOs, the opportunity to make investments in infrastructure in the production process, and greater bargaining power in relation to individual marketing all stand out as benefits.

Alves, Ferreira, & Araújo [23] identified some difficulties for the work in formal organizations of waste pickers: difficulty in understanding and applying the principles of management; difficulty in understanding that in WPO, there is no employment relationship, and therefore, the revenues are obtained by mutual work, and the income comes from the division of profits; lack of skill and knowledge on how to manage and administer an WPO; lack of capacity to carry out OARC; and difficulty with the formalization and regularization of the enterprise.

As for the CIME categories "Support from the Government and development agencies" and "Being organized with self-management", understanding the perspective of the participating waste pickers was noticed as important. This research verified the recognition by the WPO that one criterion cannot develop without the other and that these joint ventures could not survive without the government or public support for its structuring. When the criterion "Support from the Government and development agencies" was compared with the other CIME, there was an increase in the discussion about the presence of the government in the support of the work structure, equipment, and miscellaneous expenses. These results corroborate with those found by Guimarães [21] that the waste pickers are somewhat aware of the need and benefits of government support to the organization.

Regarding the CIME "Ability to compete in the market", it was observed that WPOs generally trade with the same buyers. This finding is due to the lack of market conditions in the State of Espírito Santo, the lack of conditions to transport the recyclable material, and the lack of working capital to support a longer period for the accumulation of recyclable material [4, 13].

Regarding the CIME "Ability to add value to the product" currently, WPO predominately need to add value in the sorting, pressing, and baling. Lima et al. [24] and IPEA [16] highlight the triage with the activity that adds more value, due to the diversity of products that can be generated. At the FG meeting, it was noted that there is a search for the diversification of the sorting, in order to generate specific types of product with greater added value in the process commercialization. It should be noted that WPOs discard solid waste with recyclable potential due to the low market value and the difficulty of commercializing the solid waste, either because of the nonexistence of or long distance to the buyer. In this sense, the percentage of tailings in the WPO can be high [4, 8, 25]

Another way to add value highlighted by Fidelis, Colmenero, & Ferreira [9] is the installation of a plastic processing center for grinding. According to the authors, the grinding of the plastic would make it possible to add 60% to 75% of the market value of the material. However, the authors point out that WPOs are

unable to implement such an undertaking alone because of the lack of adequate infrastructure, high implementation costs, minimal daily plastic flow that is insufficient for operation, and lack of skilled labor. WPOs tend to market mainly the items with the highest volume and commercial value, which can represent 60% of the volume sold (paper, cardboard, HDPE, PET, and LDPE) [10, 25]. These recyclable materials have a greater ability to compete in the market when compared to other recyclable waste. Steuer et al. [26] and Dutra, Yamane, & Siman [4] point out that the decrease in market values has had one of the most significant impacts for WPOs. When market values reduce in order to maintain income levels, WPOs need to market a larger amount of recyclable material [26].

Fidelis & Colmenero [25] point out that the amount of recyclable materials sold has a positive impact on the performance of WPO, but the amount of solid waste collected and the number of people working in production has a negative impact. This means that WPOs have underutilized inputs in the generation of marketable products. That is to say, the WPOs have the potential to produce more with the same inputs used. This negative relation can be attributed to the lack of equipment, infrastructure, turnover and lack of qualification of the collectors in the performance of the OARC.

3.2. Stage 2 - Check the execution status of the OARC and classify its execution (projects, process, or operation)

From the survey application at the national level, the OARC were classified according to the execution status of the WPOs: "fully performed", "partially performed", or "unperformed".

For the 74 OARC, 13% were classified as "fully performed", 49% as "partially performed", and 38% as "unperformed". Regarding execution, 72% of them were classified as process execution, against 22% for project and 6% as operation.

With respect to the activities of Block 1 (develop vision and strategy), it was observed that activities that have the characteristic of continuous and long-term execution are hampered by the conflicts between the members of the OMPs, mainly due to the lack of attendance and the rotation of its members in the WPO. The activities were mainly characterized by execution in the form of project or process, whose frequency averages were respectively 31% and 62%.

From the activities of "Develop and manage products and services" for Block 2, it was observed that the creation of new products for WPO includes production of soap and broom, as well as a new type of material to be segregated and commercialized, for example. It is observed that in the highlighted activities, the waste

pickers have looked for information to diversify the segregation, in which they also end up acquiring technical and/or tactical knowledge. It is noted that the activities in this block involve activities of self-management and planning, both for the product. Thus, it has been found that the WPO have difficulties in carrying out these activities. All activities had a percentage above 60% to be carried out in the form of a process.

Block 3 is related to one of the key activities of the WPO, the commercialization. In this sense, it deserves attention so that there is an improvement in execution in order to increase the aggregation of value to the product. Regarding the activities of “Market and sell products and services”, the WPO have sought and received support from partnerships with the municipality and other potential generators in order to increase revenues. And through capacity building and strengthening programs, WPOs have gained prospects for better placement. However, the activities related to planning and management of sales and clients are the ones that had the highest number of statements for “unperformed”. This block was also highlighted for activities to be carried out primarily as a process.

Block 4 involved activities related to “Deliver products”, and results showed that the activities related to the production stages gained the highest percentage of “fully performed” because they were the first to be performed, albeit in a disorganized way, by the waste pickers. However, WPOs do not give attention to such activities due to the practice of marketing with the intermediaries, presence of the oligopoly market, dependence on the government to obtain the raw material, and lack of managerial skills. As for the execution, activities were characterized primarily by execution in the process form, whose average frequency was 77%

The main services provided by the WPO (Block 5) to third parties are the training and promotion in environmental education and selective collection. In some municipalities, there is a partnership between the government and the WPO for the execution of these services by the waste pickers, being hired as municipal agents. It is noteworthy that although WPOs are gaining space in service delivery due to the NPSW, training is still needed to perform these activities and were highlighted to be carried out in the form of a process.

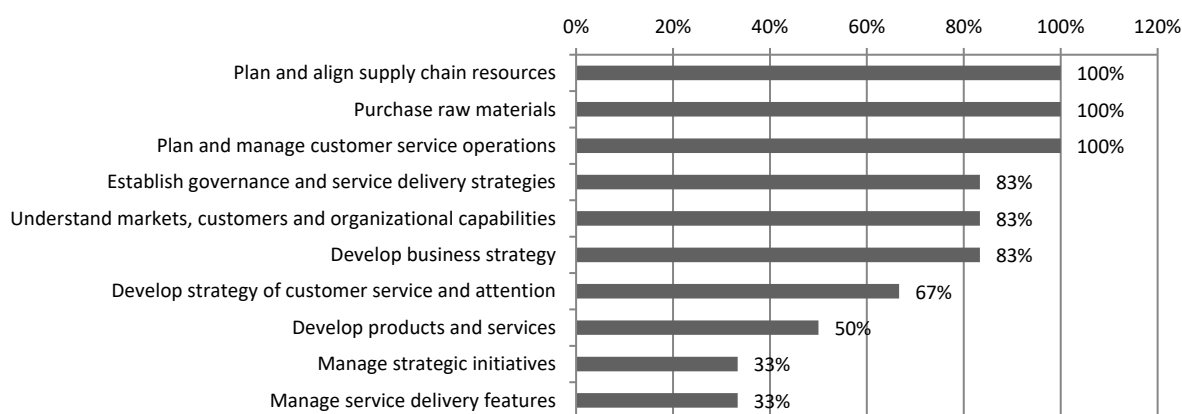
The last activities addressed in the Block 6 (Manage client service) demonstrated that due to the practice of marketing to both the oligopoly market and intermediaries, focusing recyclers of the RMGV, client service activities are compromised. As trading and selling is done with a broker most of the time, client service information almost always does not reach the WPO. When there are initiatives of the waste pickers, the

goal is to improve or develop other products. The waste pickers also observe client satisfaction when there is no return for a new purchase, and there is a need to investigate the reason for the dissatisfaction. The activities were characterized primarily by execution in the process.

3.3. Stage 3 - Consolidate the WPO collective judgment matrices to prioritize their OARC

The consolidation of the judgment matrices was performed through focus group (FG) meetings in the six ES regions. Fig. 1 presents the frequency with which the 10 OARCs of major state importance appear among the 10 most important for the 6 regions of the ES (TOP 10).

Figure 1 - Frequency of occurrence of the TOP10 State OARC among the TOP10 of the six ES regions



As can be observed in Figure 1, the OARCs "Plan and align supply chain resources", "Purchase raw materials", and "Plan and manage client service operations" were the most important (TOP3) in all the regions studied, since there is a need to create strategies for production and management of raw materials, manage demand for products according to client feedback, create plan to obtain raw materials, manage inventory, plan shipment, acquire raw material, and develop and ensure standards and procedures to maintain product quality. The activities related to the supply chain are related to environmental education, which can also be a service contracted by the collectors, in addition to the effective participation and commitment of the population.

"Plan and align supply chain resources" is of paramount importance to improve the quantity and quality of dry solid waste sent to the WPO. However, it has been observed that the plan for obtaining the USWRP is almost always controlled by the government. Thus, it is unlikely, at the present time, that WPOs make significant changes in this activity, other than acting as environmental agents to raise population awareness. It is also emphasized that even WPOs that perform the selective collection activity do not have the means

to perform such planning, since they have low level of schooling and depend on outsourced vehicles [21]. Thus, it is fundamental to invest in the environmental education of the local community, so that the USWRP sent to the WPO is of lower degree of contamination [4, 25].

"Planning and aligning supply chain resources" and "Purchase raw material" were related to the management of the collection of the USWRP, which is influenced by the following variables: number of people working in this stage, number of vehicles, quantity of USWRP collected, area of coverage, and the number of residences served [25].

Regarding the activities "Plan and manage client service operations" and "Develop strategies of client service and attention", it was noticed during FG meetings that the WPO has actions directed to this end. Currently, WPOs are in the process of meeting the requirements of intermediaries. However, it will be necessary to plan actions in the recycling market with the prospect of entrepreneurship in the capitalist system, even though they are solidary economic enterprises.

Poletto et al. [27] and Fidelis, & Colmenero [25] point out that one of the problems of marketing and meeting client standards is the heterogeneity in materials after sorting and pressing. This characteristic causes buyer distrust.

The activities "Establish governance and service delivery strategies" and "Manage service delivery features" refer to the activities of provision of selective collection and environmental education, however, only 6% of the WPOs studied carry out the selective collection.

"Understand markets, clients, and organizational capabilities" is an important activity for the financial return and continuity of WPOs. Dutra, Yamane, & Siman [4] have identified that 58% of the recycling companies are located in the Metropolitan Region. The low presence of recyclers in the other regions impacts the amounts paid for WPO recyclable waste, due to the cost of logistics. A significant part of the waste generated in the municipalities is sent to other municipalities, marketed to intermediaries that are willing to purchase from the WPO. The lack of a local market causes the devaluation of the recyclable materials, as well as ignorance on the part of the collectors with respect to the subject.

The OARC "Develop business strategy" refers to the knowledge of the business, market, clients, and strategies; however, as the WPO arose due to the social need of its members of low level of education, there are only actions directed to the mitigation of social impacts.

As for OARC "Develop products and services", the diversity of recyclable materials sorted according to the recycling market and other forms of processing such as grinding are of paramount importance for WPO

performance. An WPO achieves greater market efficiency when it has a greater diversity of products commercialized, generating a lower percentage of waste [12, 25].

In short, because of the lack of qualification of business management, the high level of illiteracy, the amount and quality of the USWRP compromised, lack of competitive technology for recycling, inadequate infrastructure, and cultural factors inherent to the collectors, the WPO do not pursue actions that strengthen the performance of OARC.

It should be noted that WPOs account for 60% to 90% of the recyclable materials that are sent to Brazilian recycling industries. Therefore, the greater the efficiency of the WPO, the better it will be for the recycling chain. In this sense, capacities are needed in the areas of business management for the WPO.

Although WPOs are based on the solidarity economy, they are embedded in the capitalist economy, so it is very important that they seek ways to become efficient in the market. WPOs should be involved in public policies related to the management of solid waste, aiming at growth in all areas (economic, social, and environmental), not only to act as social enterprises. Legal incentives will be useless if the volume and quality of USWRP is not sufficient for the WPOs, and sustainable management will not be achieved if the waste pickers representing the base of the recycling chain are not included in the municipal solid waste management, nor if their OARC are not developed in order to improve the efficiency of the system in a more efficient manner [1, 22].

4. Conclusions

The Criteria that Influence Market Efficiency "Ability to receive recyclable material", "Ability to receive and process USWRP", and "Being organized with self-management" stood out as the most important.

The operational activities of the recycling supply chain related to self-management, planning, and the long-term are those that the WPO have difficulty achieving, since they were the ones that stood out with the largest number of affirmations for partially or unrealized activities, being a consequence of related dysfunctions training and culture, such as: low knowledge about solidarity economy culture, non-adherence to the system of associativism/cooperativism, lack of specialized technical assistance, low level of schooling, frequent turnover, and lack of attendance and union by members of the WPO.

The OARC of "Planning and aligning supply chain resources", "Acquiring raw materials", and "Planning and managing client service operations" were among the top 10 activities (TOP10) with the highest priority for the OARCS in all 6 regions studied.

The hierarchical order of the OARC is the necessary tool for the development of reference models, which

aim to determine the best practices of the OARC in order to disseminate them and adapt them to other WPOs.

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