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**Municipal solid
waste management:
interdependence between
communication and
selective collection**

**Gestão de resíduos
sólidos urbanos: as
interdependências entre a
comunicação e
a coleta seletiva**

**Gestión urbana de
residuos sólidos: las
interdependencias entre
la comunicación y la
recogida selectiva**

ABSTRACT

Considering the role of communication for the effectiveness of waste selective collection programs (WSCPs), this research aimed to analyze the communication process used between the actors involved in these programs. To achieve the objective, a city located in the countryside of the state of São Paulo, Brazil was used as a case study. Information transmission diagrams were created, based on Shannon and Weaver's model, and adapted by DeFleur, so that communication gaps in the explored WSCPs could be identified, indicating possibilities for improvement. Among the results obtained by the study, it was found that there is a distance between the population and the cooperative that harms the interactivity between these actors; the information provided is currently insufficient to reinforce the behavior of the population, as it does not consider environmental, social, and economic factors as a form of mobilization; and the most effective means of communication with the population (truck loudspeakers) is no longer used to publicize the program. In this study, it is understood, by 'sufficient information', the one that is capable of raising awareness among the population, as well as mobilizing them to join the program. Thus, communication in the analyzed WSCP still needs improvement, since the study identified noises in communication that lead to failures in selective collection in the city in question.

Keywords: Municipal Solid Waste. Communication. Selective Collection. Public Policy. Recycling Cooperative.

RESUMO

Considerando o papel da comunicação para a efetividade dos programas de coleta seletiva (PCS) de resíduos, a pesquisa teve como objetivo analisar o processo comunicacional utilizado entre os atores envolvidos nos PCS de resíduos. Para consecução do objetivo, utilizou-se como estudo de caso um município localizado no interior do estado de São Paulo, no Brasil. Na pesquisa foram criados diagramas de transmissão da informação, baseados no modelo de Shannon e Weaver e adaptado por DeFleur, para que então fossem identificadas as lacunas da comunicação no PCS explorado e indicadas possibilidades de melhoria. Dentre os resultados obtidos no estudo constatou-se que há o distanciamento entre população e cooperativa que prejudica a interatividade entre estes atores; as informações veiculadas atualmente são insuficientes para reforçar o comportamento na população, pois não levam em consideração fatores ambientais, sociais e econômicos como forma de mobilização; e o meio de comunicação mais eficaz perante a população (autofalantes nos caminhões) já não é mais utilizado para divulgação do programa, sendo certa a compreensão de que a informação suficiente está pautada naquela capaz de conscientizar a população, bem como mobilizá-la para aderir ao programa. Desta forma, a comunicação no PCS analisado ainda carece de melhorias, uma vez que o estudo identificou ruídos na comunicação que conduzem a falhas na coleta seletiva do município em questão.

Palavras-chave: Resíduos Sólidos Urbanos; Comunicação; Coleta Seletiva; Política Pública; Cooperativa de Reciclagem.

RESUMEN

Considerando el papel de la comunicación para la efectividad de los programas de recogida selectiva de residuos (PCS), la investigación tuvo como objetivo analizar el proceso de comunicación utilizado entre los actores involucrados en los PCS de residuos. Para lograr el objetivo, se utilizó como estudio de caso una ciudad ubicada en el interior del estado de São Paulo, en Brasil. En la investigación, se crearon diagramas de transmisión de información, basados en el modelo de Shannon y Weaver y adaptados por DeFleur, de manera que se pudieran identificar las brechas de comunicación en los PCS explorados e indicar las posibilidades de mejora. Entre los resultados obtenidos en el estudio, se encontró que existe una distancia entre la población y la cooperativa que perjudica la interactividad entre estos actores; la información brindada es actualmente insuficiente para reforzar el comportamiento de la población, ya que no toman en cuenta los factores ambientales, sociales y económicos como forma de movilización; y el medio de comunicación más efectivo con la población (camiones parlantes) ya no se utiliza para dar a conocer el programa, en el entendido que se basa información suficiente en aquella capaz de sensibilizar a la población, así como movilizarla para sumarse a la programa. Así, la comunicación en los PCS analizados aún necesita mejora, ya que el estudio identificó ruidos en la comunicación que conducen a fallas en la recogida selectiva en el municipio en cuestión.

Palabras clave: Residuos sólidos urbanos. Comunicación. Recogida selectiva. Política pública. Cooperativa de reciclaje.

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1. Introduction

The generation of urban solid waste (USW) has increased considerably around the world over the last few decades. This factor is due to population growth and intensified consumption in which a large amount of disposable materials is incorporated into social habits. Therefore, managing USW represents a great challenge to the government.

Public managers must understand that management effectiveness depends not only on economic and political aspects, but also on the contribution of the population to the correct management of USW, which involves habits of selection and correct disposal of waste, as well as its minimization at its source (JACOBI; BESEN, 2011; GONÇALVES; TANAKA; AMENDOMAR, 2013). For this purpose to be achieved, it is essential to integrate and mobilize the different actors that are inserted in society, in which communication is the fundamental instrument to achieve this end.

Only strategically implemented communication can contribute to the success of public policies, by extension, to waste selective collection programs (WSCP). Hence, it is essential to use it as an indispensable factor for the success of public policies and not only as an accessory, as it is largely responsible for impacting the attitudes, opinions, and beliefs of

citizens (DORANTES Y AGUILAR, 2012; BAKHOV, 2013; ROMANENKO, 2016).

Some authors draw attention to possible failures that occur in the communication process, both at the organizational level and at the public level. Some of the obstacles to the organizational communication success are: 1. The lack of integrated communication (BRINGHENTI, 2004; KEYTON, 2005; KUNSCH; MOYA, 2014); 2. The lack of appreciation of the professionals involved (BUENO, 2009); 3. The departmentalization of sectors and consequent barriers in spatial distance (LACOSTE, 2005); 4. The lack of trust from stakeholders (BUENO, 2009; 2017); 5. Lack of alignment in institutional values (BUENO; 2009), and 6. Lack of human and financial resources.

At the level of public communication, the main barriers are: 1. Inadequacy of codes / signs / symbols between the sender and the receiver (MARTÍN-BARBERO, 2006; SANT'ANNA; ROCHA JÚNIOR; GARCIA, 2015; ROMANENKO, 2016); 2. The confusion promoted by complex messages (WILLIAMS; COLE, 2013; BERRIO-ZAPATA *et al.*; 2016); 3. The lack of a greater frequency of information on the topic, seeing that there is a discontinuous dissemination of information about WSCP in the investigated city (MATOS, 2012; HOGARTH; SOYER, 2015; ROMANENKO, 2016, CHRISTENSEN; NILSSON, 2018); 4. The lack of internalization by the receiver in front of what is being proposed, in other words, the existence of information asymmetry between the codes used by the actors involved in the process (BROWN; DUGID, 2001; MARTÍN-BARBERO, 2006; SANT'ANNA; ROCHA JÚNIOR; GARCIA, 2015); 5. The lack of face-to-face contact (READ, 2001;

ZÉMOR, 2012; PERUZZO, 2012); 6. The lack of environmental, social, and economic encouragement in the content of the message (FERNANDES, 2015; BERRIO-ZAPATA *et al.*; 2016); 7. Discontinuous disclosure of information only on waste management in the city, with a focus on WSCP (OXFORD BROOKES, 1999; ENVIRONMENT AGENCY, 2000; BRINGHENTI; GÜNTHER, 2011); 8. The standardization of the channel for various audiences on current WSCP information (CEZAR, 2018); 9. Message size inadequacy in relation to the population's preference, seeing that the programs are failing to consider the so-called 'less effort principle', in which individuals tend to choose information that use less energy (WALTON, 1993; BERRIO-ZAPATA *et al.*, 2016); 10. The used channels do not have the power to transmit feedback from the population (MATOS, 2012; PIERANTI; MARTINS, 2008; KUNSCH; MOYA, 2014) and, finally, 11. The presence of a unidirectional public communication process, with little feedback (ROMANENKO, 2016).

In the WSCPs, the communication process is also ineffective, as it does not allow for changes in the attitude of the population regarding the generation and prior selection of waste in their homes, as well as their interest in the topic.

Thus, this research aimed to analyze how communication takes place in WSCPs of USW. For this, the communication process used in a WSCP in the city of Tupã, located in the countryside of the state of São Paulo, Brazil, was outlined, in which communication gaps were identified. Finally, possibilities for improvement in the investigated communication aspects were identified.

2. Methodological Procedures

To delineate the communication process used in the explored WSCP, an exploratory and descriptive analysis was carried out through the application of forms to public managers (from the Department of Agriculture and Environment and the Press Section), to the president of the recycling cooperative, and to a sample of the local population.

After obtaining the data through the applied forms, four diagrams of information transmission were created based on the model by Shannon and Weaver, and adapted by DeFleur, between (a) Department of Agriculture and Environment and the Press Section, (b) city hall and cooperative, (c) city hall and population, and (d) cooperative and population.

Based on these models, it was possible to identify the agents involved in the process: the sender(s), recipient(s), transmitter(s) of the message, used channel(s), noise(s) present, and feedback mechanisms (if any).

Through the noise diagnosed in the previous step, it was also possible to identify the gaps in communication, comparing the data obtained with what was proposed in the analyzed bibliographies.

Finally, through the detected gaps, it was possible to propose improvements in the investigated communication aspects, also based on the proposed literature.

Data collection

For data collection, surveys with predefined questions were used, with an issued authorization from the city mayor to carry out the research with the city managers, as well as an authorization from the president

of the cooperative for the research to be carried out at the institution. In addition, before applying the forms to the population, respondents signed an informed consent form authorizing the disclosure of their responses. In the case of the household data, they were treated in an aggregated manner in such a way that the interviewees could not be identified and remained anonymous. Finally, in order to guarantee the integrity and dignity of all the interviewed people, the survey was sent to the Ethics Committee, through 'Plataforma Brasil'. The Committee issued an opinion approving the research, so the work could continue.

To apply the survey forms to the population, it was necessary to select a sample of households that would be representative of the reality of this city. For this, two sampling techniques were used: stratified sampling and cluster sampling. According to Martins (2010), the first can be used when the population is heterogeneous and the researcher wants to distinguish relatively homogeneous subpopulations, called strata, while the second is a simple random sampling in which the sampling units are the conglomerates themselves defined by the researcher, being widely used in large geographic areas.

For stratified sampling, the expression (1) was used:

$n = \frac{\sum_{i=1}^k \left(\frac{N_i^2 \hat{p}_i (1 - \hat{p}_i)}{w_i} \right)}{N^2 D + \sum_{i=1}^k N_i \hat{p}_i (1 - \hat{p}_i)}$	<p>(1)</p>
<p>Source MARTINS, 2010.</p>	

Table 1, below, shows the variables present in expression (1) and their definitions.

Table 1 – Variables used to calculate the stratified sample and estimating the population proportion (qualitative variables).

Source: Adapted from Martins (2010)

Variable	Definition
k	Number of strata
N _i	Number of elements in the stratum i
N	Number of elements in the population ($N = N_1 + N_2 + \dots + N_k$)
\hat{p}_i	Estimate of the true proportion of stratum i, which can be evaluated by technical specifications, by value retrieval in similar studies, or by conjecture based on pilot samples. If there are no previous estimates for \hat{p}_i , assume $\hat{p}_i = 0.5$, thus obtaining the possible sample size.
w _i	$w_i = \frac{N_i}{N}$
D	$D = \frac{d^2}{(z^{\alpha/2})^2}$ Where d is the sampling error (or margin of error), expressed in decimals, and $z^{\alpha/2}$ is the abscissa of the normal distribution.

Considering expression (1), the first step of this sampling was to divide the city into areas that represented the local reality. This was followed by the division carried out by the city hall itself to perform the collection of USW, namely: North Zone, South Zone, East Zone, West Zone, Downtown, Parnaso District, Universo District, and Varpa District.

After defining these eight regions, or strata ($k = 8$), the number of households in each region was identified, based on the online platform of the Brazilian Institute of Geography and Statistics (IBGE), which considers the 2010 Census (IBGE, 2010a). It should be noted that, due to the fact that there is no municipal law that subdivides the city into these regions, the IBGE does not use this division for its calculations. Hence, it was necessary to calculate the number of households based on the census sectors, which is a classification used by IBGE at the national level, and transpose these numbers to the division performed in this research (Table 1).

After obtaining the number of households per stratum, a sampling error (or margin of error) of 10% ($d = 0.1$) was defined, with a confidence level of 95% ($z_{\alpha/2} = 1.96$), and $p_i = 0.5$ as an estimate of the true proportion of each stratum i , since there is no previous data.

According to the representativeness of each city region, a total sample size of 97 households was defined by expression (1), where the sample size of each stratum is shown in Table 2, below.

Table 2 – Sampling stratified by number of households.

Strata	Number of households	Representativeness	Sample size
North Zone	1.833	9,03%	9
South Zone	2.882	14,20%	14
East Zone	8.876	43,73%	42
West Zone	2.977	14,67%	14
Downtown	3.232	15,92%	15
Parnaso District	148	0,73%	1
Universe District	191	0,94%	1
Varpa District	159	0,78%	1
TOTAL	20.298	100%	97

Source: Prepared by the authors based on data from IBGE (2010a).

After determining the sample size, the households were selected through cluster sampling, in which the blocks where the forms would be applied were randomly drawn by the Bioestat software. Data collection took place on Saturday mornings in October, 2018.

3. Results and Discussion

3.1. Communication processes existing in the WSCP

To explain the communication processes existing in the WSCP of the studied city, the subtopic in organizational and public communication was broken down in order to facilitate the understanding and analysis of the processes. After describing the communication processes, it was possible to verify the gaps (noise) existing in them and propose improvements in the process, as presented in the subtopics below.

3.1.1. Organizational communication

For better visualization and interpretation, the process was broken down into two diagrams, namely: communication between (a) Department of Agriculture and Environment, as well as the Press Section; and (b) City Hall and cooperative. It is important to justify that the last process was considered organizational communication due to the cooperative's total dependence (financial resources, human resources, food, transport, social assistance, etc) on City Hall, as if the first were a department of the second, in such a way that if the second did not exist, it would not be possible to have the first.

Figure 1 illustrates the organizational communication process between the Department of Agriculture and Environment, and the Press Section.

As shown in Figure 1, in the direct process, the origin and the transmitter are the same people, in this case, the employees of the Department of Agriculture and Environment. The receiver and destination are also the same, in this case, the employees of the Press Section. The means used by them for the

communication process are the telephone and social networks. It is noticed that the actors are inverted in the feedback process; the origin and the transmitter become the employees of the Press Section, while the receiver and the destination become the employees of the Department of Agriculture and Environment. However, the means, remain the same.

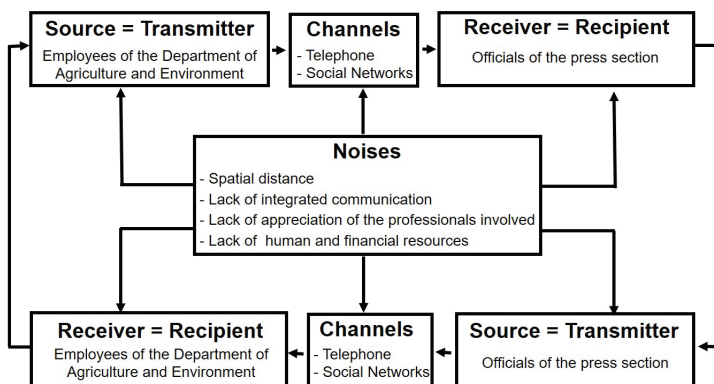


Figure 1 – Communication process between the Department of Agriculture and Environment, and the Press Section.

Source: Prepared by the authors.

Four aspects were identified as noise: 1) the spatial distance between the Department of Agriculture and Environment, and the Press Section; 2) the lack of integrated communication among these departments; 3) the lack of appreciation of the professionals involved in the process, and 4) the lack of human and financial resources.

From the first noise (spatial distance) the second (absence of integrated communication between departments) is generated, which is a phenomenon already pointed out in the literature by Bringhenti (2004), Keyton (2005) and by Kunsch and Moya (2014), now

confirmed in this case study. Both departments indicated that communication between the sectors could be improved, suggesting that a professional be responsible for making this link between the departments.

It should also be mentioned as noise the lack of appreciation of the professionals involved in the process, as highlighted by Bueno (2009). Both in the Press Section and in the Department of Agriculture and Environment, the professionals involved said they felt little motivated to create awareness campaigns for the selective collection of USW. This is due to the lack of motivation on the part of the management (third noise), also due to the lack of financial resources and the lack of existing professionals in the sectors (fourth noise).

Regarding the communication between the City Hall and the cooperative, the communication process undergoes some changes, as shown in Figure 2.

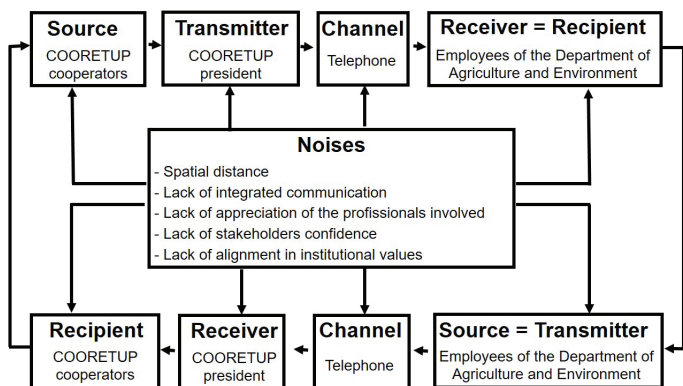


Figure 2 - Communication process between the City Hall and the cooperative.

Source: Prepared by the authors.

Some of the noises that occurred in the previous process were also identified in the current one: spatial

distance (LACOSTE, 2005), absence of an integrated communication, and lack of appreciation of the professionals involved in the process. In addition to these, two other noises were detected: 1) the lack of trust from the stakeholders, and 2) the absence of an alignment of institutional values.

The lack of appreciation of the professionals involved in the process, evidenced by Bueno (2009), is also present, as both the professionals from City Hall and the cooperative said they felt unmotivated to improve the WSCP, precisely because of the lack of trust between them (BUENO, 2009; 2017).

The lack of alignment in institutional values is here highlighted (BUENO, 2009), because while the cooperative focuses on incoming material quality, City Hall's main purpose is to keep the city 'clean', not caring so much about the environmentally appropriate final destination of the waste. These different purposes make it difficult for the municipal body to work together with the cooperative.

After analyzing the processes involving organizational communication, it was explored how public communication takes place involving the WSCP of the city, as per the following subitem.

3.1.2. Public Communication

To understand the processes used in public communication, it was first necessary to understand the profile of the population and its participation in the WSCP. From this survey, it was possible to describe the communication process existing between (a) City Hall and population, as well as between (b) cooperative and population, identifying the actors, channels, and noise (gaps) existing in the processes.

The results obtained from this step are presented below.

3.1.2.1. Identification of the population profile and participation in the WSCP

Starting with the data extracted from the Brazilian Institute of Geography and Statistics (IBGE, 2010a) and from the survey applied to the population sample, it was possible to identify the aspects that concern the population. In addition, with the interaction of data obtained from the population with data collected from public managers and the president of the cooperative, it was possible to identify the participation of the population in the WSCP.

Initially, the sample of citizens was asked if they had heard about the city's WSCP, in order to verify if they had knowledge about the project carried out by City Hall in partnership with the cooperative. As a reply, 100% of respondents said yes, indicating that they have heard of it and that the project was already known to everyone (from the sample).

In order to verify whether the dissemination of the WSCP was carried out with media diversification, respondents were asked to choose on which media they have seen/heard anything regarding the program (Figure 3).

In Figure 3, it should be noted that at least 3% of the surveyed residents have seen/heard about the program through any of the media presented. It is also noted that loudspeakers attached to cars or trucks, local radio stations, and 'other means of communication' were the most efficient means of communication to promote the WSCP. Among the 'other means' mentioned, two stand out, namely: lectures given in schools and organizations at the beginning of the program and interaction with neighbors.

It should be noted that loudspeakers are no longer used recently. This fact has negative impact according to part of the population, as these individuals said that the WSCP jingle was attractive and, when they listened to it, they immediately put the recyclable materials on the sidewalk for the collecting truck to pick up. However, today, due to the lack of this reminder, many of the respondents affirmed that they often have to wait until the following week to put the recycling waste outside for collection, or they just choose to dispose of this waste along with the organic one, since the organic waste trucks circulate with a bigger frequency.

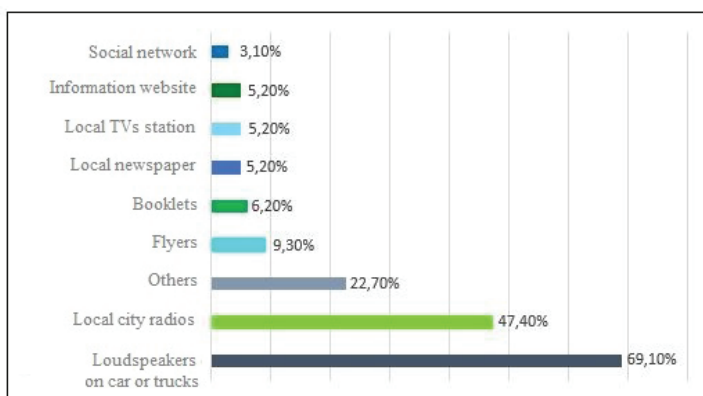


Figure 3 – Means of communication used in the WSCP

Source: Prepared by the authors.

In order to verify if the codes were inadequate between the sender and the receiver of the information, the citizens participating on the research were asked if they could understand the content of the transmitted message. As a result, it was found that 88% of respondents affirmed to clearly understand the message conveyed about the WSCP (Figure 4).

From the results of Figure 4, it can be stated that, in this study, the codes, signals, and symbols that mediate the message between the sender and the receiver are mostly adequate, contradicting the premises of Martín-Barbero (2006), Sant'anna, Rocha Júnior and Garcia (2015), and Romanenko (2016) who consider that the faults are usually in the inadequate code, signal, and symbol between the sender and the receiver.

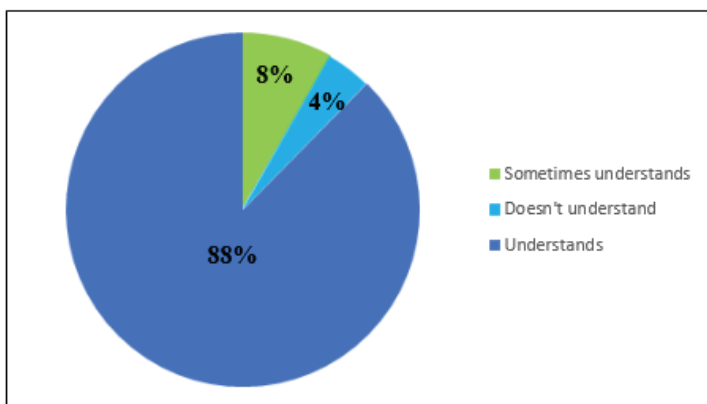


Figure 4 – Understanding the content of the transmitted message.

Source: Prepared by the authors.

The idea of Willians and Cole (2013) and Berrio-Zapata *et al.* (2016), in which the messages could be complex, creating room for confusion, was also not confirmed in this research, as only 12% of respondents had problems understanding the content of the message.

To identify whether message repetitions occur in order to internalize them individually, respondents were asked to select the current frequency of the awareness campaigns of the program. Table 3, below, shows the results obtained from the research.

Table 3 - Current frequency with which the awareness campaigns of the WSCP reach the respondents.

Frequency	Percentage
Always	4%
Often	7%
Sometimes	16%
Rarely	28%
Never	45%

Source: Prepared by the authors.

It is worth highlighting that, in Table 3, almost 75% of respondents said they never or rarely have heard about the awareness campaigns of the WSCP. According to the theoretical assumptions of Matos (2012), Hogarth and Soyer (2015), Romanenko (2016), and Christensen and Nilsson (2018), several repetitions of information about a theme in the daily lives of people allow the message to be internalized by individuals. The data here obtain demonstrates that the information provided is insufficient to reinforce the behavior of the population as described by the aforementioned authors.

Another query was whether the respondents appeared to have any knowledge about the recyclability of materials. This question was asked with the purpose of verifying if the transfer of the message is being effective, that is, if the receiver is able to internalize what is being suggested. Most of the individuals from the sample displayed knowledge regarding which materials are or are not recyclable (53.3%). Nevertheless, when these same individuals were asked about specific types of materials (such as Styrofoam,

egg packaging and tomato sauce sachets), they were unable to answer whether they should be sent to the cooperative or to the municipal landfill. Thus, the premises of Brown and Dugid (2001), Martín-Barbero (2006), and Sant'anna, Rocha Júnior and Garcia (2015), in which there may be information asymmetry between the actors involved in the process, is confirmed in this research.

In another question of the survey, citizens were asked if they disposed of part of their waste to self-employed collectors (mainly materials with greater added value, such as metal cans and PET bottles) and why did they do so. This question was asked in order to investigate whether there is inconsistency in the communication process in a way that it doesn't sufficiently highlight the social role of the cooperative. As a result, only 24.7% of respondents said they prefer to give materials with greater added value to self-employed collectors, while 75.3% said they did not donate anything.

This considerable portion of individuals who separate their materials in order to donate to specific people (almost a quarter of the sample) said that they do so with the purpose of financially helping self-employed collectors. It is clear, then, that there is a precariousness of communication between the WSCP and the public, since the program is not adequately featuring the social project that is carried out with the cooperative, in a way that the population is still not aware of the importance of the program among the social sphere.

Another question was whether citizens knew the day and time in which the selective collection truck does its round in their neighborhood, with the objec-

tive of verifying whether the tendency to pay attention to what impacts their reality is confirmed. In this aspect, 88% of the sample says they are aware of the day that the recycling waste truck circulates their neighborhood. Thus, it confirms the idea that there is a tendency for individuals to notice what impacts their reality, in this case, knowing the day that collectors collect their waste is important to the population.

When the sample was asked if they knew how selective collection can help the environment (to verify if there is a lack of in-depth information on the subject in the message content), 64.1% said that, yes, they knew, while 35.9% admitted to not know.

Although most respondents say they know how selective collection can help the environment, they are confused about the ways in which this help takes place. It can be seen then that, despite people being informed about the impact of waste on environmental issues, there is still a lack of in-depth information on the subject.

Another fact that drew attention in this study was that, when asked whether the interviewees knew about the cooperative, with the aim of investigating if there is contact between the population and the cooperative or if there is a distance between them, 92.8% of respondents said they did not know it. The gap between the cooperative and the population demonstrates the perception that social issues are not highlighted in the WSCP, as a large part of the population does not know the cooperative or the work that is carried out there.

It is also important to point out that this lack of interaction between the population and the cooperative is due to the abandonment of awareness programs

by the cooperative. According to data obtained, at the beginning of the program, there were partnerships with schools in the city and technical visits were constant. Currently, these visits are presented in an isolated way, resting only on the teachers' own initiative to take the students on field trips.

Next, the interviewees were asked if they thought that the separation of waste contributes to the city's economy. The purpose of this question was to identify whether the population is presented with information about the economic gains that the WSCP generates for the city. The result revealed that the number of people who said they knew or did not know the economic importance of selective collection was balanced (48.9% said they knew, while 51.1% did not know). However, as with environmental issues, individuals were confused when trying to explain the ways in which the program helps the city economically. The interviewees who claimed to know how waste selection contributes to the city's economy only mentioned the income generation that is provided to those who work in recyclable waste sorting. However, they were unable to answer which organization had this function, as already pointed out above.

Thus, it is understood that there is a lack of in-depth information to the population about the economic gains that the WSCP generates for the city. As an example, no one seemed to know about how recycled waste promotes savings to the city's expenses by not using the landfill.

When asked if they receive current information on how selective collection is conducted in the city, 89.1% of the respondents said they did not receive, confirming what is said on the studies by Oxford

Brookes (1999), Environment Agency (2000), and Bringhamti say and Günther (2011), who all point to a lack constant disclosures of data on waste management in cities.

The managers of the Department of Agriculture and Environment and the Press Section, on the other hand, affirm that local radio stations are frequently informing the population about the progress of selective collection.

Confronting these data, it is noted that, since only part of the population listens to radio programs (in the sample, only 47.4% said they did, as shown in Figure 3), this fact proves that, recently, not all means of communication are properly used to inform the population about the WSCP. Thus, the idea of Cezar (2018) who says that information does not reach the various audiences due to a lack of media diversification was proven in this research, as current information about the WSCP is not reaching the various audiences due to the lack of media variety.

Regarding the preference on the size of the message to be used to disseminate information about the WSCP, in order to identify whether the 'less effort principle' is confirmed in this study, it was found that more than half of the citizens prefer texts containing less content, so that the message can be read or heard quickly (Figure 5).

This result demonstrates compliance with the 'less effort principle' pointed out by Walton (1993) and Berrio-Zapata *et al.* (2016), which states that individuals tend to choose information that requires less energy to be understood, that is, the smaller the message content, the greater the chance that the person will opt for it.

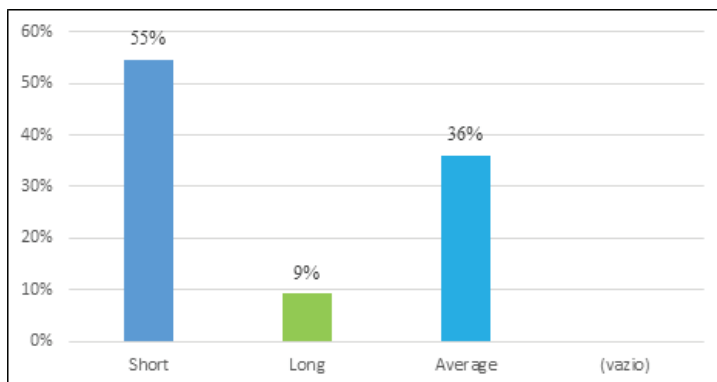


Figure 5 – Message size.

Source: Prepared by the authors.

Finally, the preferred media for providing feedback is shown on Figure 6, below.

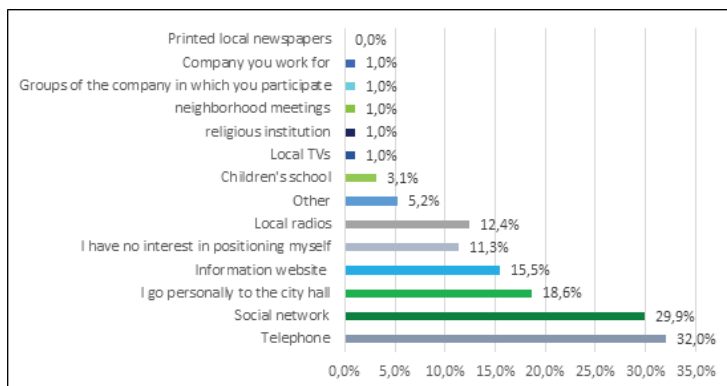


Figure 6 – Population's preferred means of communication for feedback on the WSCP.

Source: Prepared by the authors.

Of all the mentioned media, the population's preferred means are the telephone (32%), followed by social networks (29.9%). About 18.6% of the sample of citizens said they preferred to go to City Hall in person;

15.5% indicated that they give feedback on the website of City Hall or on the city's information websites; 12.4% prefer to call the radio to give their opinion, and 11.3% said they are not interested in giving their opinion about the program.

The other means of communication mentioned by the respondents represent 5.2%, among which they highlighted giving feedback directly to garbage collectors, informing a city councilor, or talking to someone they know who works in City Hall.

Giving feedback through school, whether from children or acquaintances, scored 3.1%. Businesses, society groups, neighborhood meetings, religious institutions, and local TV stations had a very small audience preference, just 1%. Finally, local newspapers were not chosen by any of the interviewees.

Thus, based on the data presented and on theoretical assumptions, it was possible to outline the public communication used in the program, highlighting the noise found, as per the following subtopic.

3.1.2.2. Description of the communication process

In public communication, there is the communication process taking place between (a) City Hall and the population, and between (b) cooperative and the population. Figure 7 presents the first process.

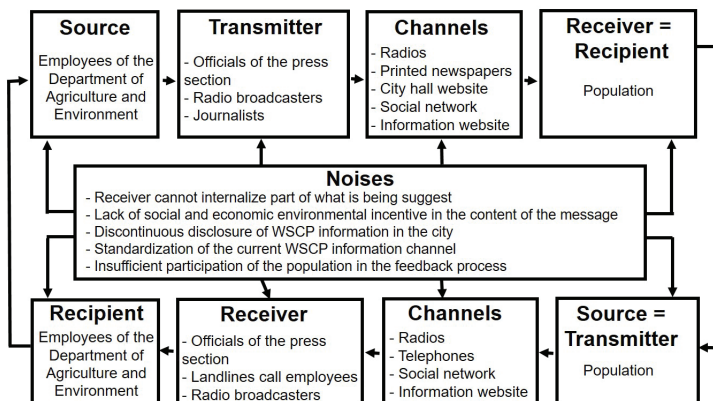


Figure 7 - Communication process between City Hall and population

Source: Prepared by the authors.

It can be seen that, in the direct process (Figure 7), the origin is 'employees of the Department of Agriculture and Environment'. The transmitters are listed by various actors: employees of the press section, broadcasters, and journalists from local newspapers. The receiver and the destination are the same actors, in this case: the population. The channels used for this public communication are numerous, namely, radios, printed newspapers, City Hall website, social networks, and information sites.

The noises found in this process have already been identified and explained in the previous subtopic. Thus, Table 4 brings them together in order to facilitate visualization.

Table 4 – Synthesis of existing noise in the communication process between City Hall and population

Noise		Situation that occurs
1	Receiver cannot internalize part of what is being suggested (BROWN; DUGID, 2001; MARTÍN-BARBERO, 2006; SANT'ANNA; ROCHA JÚNIOR; GARCIA, 2015).	The population is in doubt about the recyclability of materials.
2	Lack of incentive in the message content (FERNANDES, 2015; BERRIO-ZAPATA <i>et al.</i> ; 2016).	Lack of environmental, social, and economic incentive in the message content.
3	Lack of constant dissemination of data on waste management in the city (OXFORD BROOKES, 1999; ENVIRONMENT AGENCY, 2000; BRINGHENTI; GÜNTHER, 2011).	The population does not obtain current information on the status of USW management, especially of the WSCP.
4	Channel standardization for different audiences (CEZAR, 2018).	Only local radio stations publicize current WSCP problems.
5	Generally, the public communication process takes place in a unidirectional way (ROMANENKO, 2016).	There is not enough participation of the population in the feedback process.

Source: Prepared by the authors.

Figure 8, below, shows the communication process that takes place between the cooperative and the population.

It can be noticed, in Figure 8, that in the direct process, the origin is the cooperative members of CO-ORETUP, while the transmitter is the president of the cooperative, who broadcasts the awareness message through technical visits from educational institutions (channel) to teachers and students of these institutions (receivers), in order to get the message to their family member, friends, and/or acquaintances, who most of the times are residents of the city. Thus, the destination is the population of the studied city.

As noise, one can mention the lack of face-to-face contact that hinders the interactivity between the sender (cooperative) and the receiver (population), as pointed out in the studies by Read (2001), Zémor (2012), and Peruzzo (2012). In addition, there is a lack of constant dissemination of data on waste management in the city (OXFORD BROOKES, 1999; ENVIRONMENT AGENCY, 2000; BRINGHENTI; GÜNTHER, 2011), especially concerning information on the WSCP that is held by the cooperative.

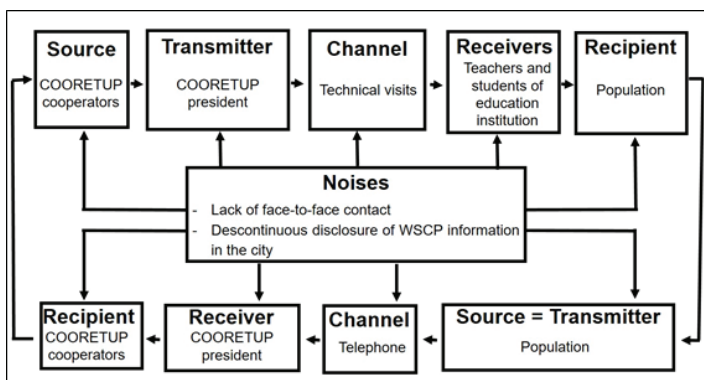


Figure 8 - Communication process between cooperative and population

Source: Prepared by the authors.

After describing the communication processes used in the WSCP, this study proposes measures to improve the WSCP communication system in the next subtopic.

3.2. Improvement proposals for the WSCP communication system.

Below, some proposals for the improvement of the communication process used by the waste selective collection programs of the investigated city are shown,

according to the design observed in this research, in order to promote positive results in the process.

Both sectors pointed out the difficulty of the Press Section in meeting the demand required by the Department of Agriculture and Environment, not only with regard to the WSCP, but in all existing needs for this department. The main problem encountered is the lack of integration between the sectors, mainly due to the physical distance between them.

One measure would be the decentralization of the Press Section, in which each employee would remain in the final department, as is the case with the Department of Agriculture and Environment. This measure would facilitate the involvement of the communication professionals with the daily demands of the department. In the case of the WSCP, closely monitoring the work carried out by the collectors and the cooperative would provide more adequate mobilizations, reaching, for example, specific target audiences, in addition to more frequent campaigns, since the behavior that is not reinforced tends to be forgotten.

Regarding the cooperative and the population, there is a lack of interaction between them. So, it is proposed that the cooperative rethink its way of acting in relation to awareness, since the quality of the material that arrives as raw material depends on the population's efforts to separate and select its waste. Thus, social mobilization cannot be seen as a secondary action, but as an endogenous part of the process, as already predicted by Dorantes y Aguilar (2012).

Regarding the means of communication used by City Hall to mobilize and inform the population about the WSCP, it was found that the most effective means for the population were the loudspeakers attached to

the recyclable material collection trucks, which are currently no longer used, as already mentioned above. It is then recommended that the government brings the use of loudspeakers back. However, it is also recommended that a new vignette be made in order to include not only the environmental role of selective collection, but also social and economic aspects that the selection of waste in households provides. It is important to clarify that the proposal does not diminish the importance of other communication channels such as radios, social networks, and printed newspapers, as there can be no standardization of a single channel for different audiences, as pointed out by Cezar (2018).

Another point to be considered is the issue of material specificities. Although the majority of the population says that they participate in the collection, it is clear that there are still doubts about some specificities of some materials and how to pack them, for example, whether or not it is necessary to wash something. It is then indicated that awareness campaigns incorporate these issues that the population needs clarification.

It is also recommended that evaluations and monitoring be carried out by the municipal government regarding the effectiveness of the communication process, as pointed out by Grodzi'Nska-Jurczak *et al.* (2006) in their study, which examined the effects of campaigns on municipal solid waste management in Jaslo, Poland.

4. Final Remarks

The purpose of the study was to explore the theme of communication within waste selective collection

programs (WSCPs), in order to introduce new debates on the topic, since the subject is scarce in the literature.

The methodological procedures of this research allowed us to analyze the forms of communication adopted in the WSCP of urban solid waste (USW). The representative sample of the studied population, the interview carried out with municipal public managers and the president of the cooperative were essential to portray the way in which communication is inserted in the program. For this case study, it was necessary to intensely explore all the variables that could interfere in the communication process of the WSCP, in view of the adopted theoretical assumptions.

There were some positives aspects found in WSCP communication: 1) the program is well disseminated among the population; 2) the population knows the days that the selective collection truck does its round on their respective areas; and 3) and the means of communication for feedback are adequate to what the population prefers.

However, there were also opportunities for improvement in this system, among which the scarce communication of selective collection, which should inform the population of the WSCP situation, stands out; the recent lack of use of loudspeakers, which were assessed as the means with the greatest power to disseminate information, as reported by the population and corroborated by the managers of the Department of Agriculture and Environment, as well as the Press Section. Furthermore, despite the respondents saying that they know how selective collection can help the environment and the city's economy, they were incapable of explaining exactly how this

happens, pointing out that the population lacks in-depth information on the subject.

Regarding the formula presented in Figure 1, it is necessary to emphasize that its content does not constitute a means of full insight for the transmission of the proper operation, although it is revealed as a mechanism, albeit informal, capable of contributing to communication between the municipality and the press.

In view of the situations presented, it is understood that the communication carried out by the WSCP in this case study still needs improvement, since the research identified noise in public and organizational communication that led (and lead) to failure in selective collection.

This analysis concluded that, in order to promote social mobilization through communication, it is necessary to carry out a prior reading of the codes used by the population, in order to consider cultural characteristics, socioeconomic factors, location of households, and the cognitive profile of each target audience. This way, it would be possible to adapt the message and channel to each population profile, ultimately providing greater assimilation of information by individuals and consequent improvement in the participation of this public policy.

Even so, it is necessary to emphasize that the reasons that led the participants to participate in the statistical survey carried out in this study are still unclear, considering that the reasoning is based primarily on a theoretical basis. Nevertheless, community cooperation can be demonstrated as a mechanism for social advancement, given that they were able to capture the importance of the subject when requested to do so.

Future research should investigate the possibilities of community communication to promote awareness of the population regarding WSCPs, such as having a known leader in the neighborhood talking to the local population, which can contribute, as shown in the literature, to understand what each resident believes and the attitudes they take, so that they can influence collective actions. This face-to-face contact with people who are habitual in the neighborhood can generate a relationship of trust and support for residents. In addition, it would also be advised a deeper analysis of digital forms of communication (social networks and mobile applications) in waste management.

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