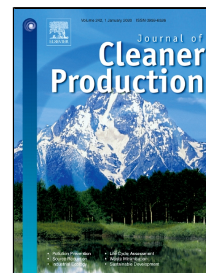


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Critical factors for environmental regulation change management: evidence from an extended producer responsibility case study

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Abstract

Contemporary environmental challenges have led governments to seek innovative ways to overcome the limits of traditional regulatory models, demanding a “change management”. This article addresses a case study regarding innovations promoted in the extended-producer responsibility (EPR) implementation by São Paulo state, Brazil. After facing resistance from industry, local government changed its approach from traditional regulation to negotiated agreements. As one of the researchers was an active part of the process, the Active Research method was adopted, through the “changing as three steps” model, aiming to understand how change occurs and what its critical factors (facilitators, barriers and improvement opportunities).

Results indicate that the incorporation of the principles of regulatory quality has made it possible to overcome the gridlock and reopen the dialogue, leading to agreements between industry and government. The evidence also shows that the EPR strategy has been continued and expanded, with the renewal of commitments with more ambitious goals, besides the inclusion of retailers in some EPR systems. Regulation has also evolved, with the incorporation of EPR in the environmental permitting, intending to combat free riders.

Facilitators for change included recognition of the government, a gradual approach, cultural changes in companies and the systematization of information. Among the barriers, the most crucial were the low adherence of retailers and importers, the considerable presence of free riders, difficulties with the participation of municipalities, the absence of tax incentives, the low adhesion of generators, high operating costs, and collection problems. Finally, among the opportunities for improvement, results show the expansion of participants, mainly municipalities and retailers, a tax review, inclusion in environmental education programs, incorporation in environmental permitting, increased surveillance to combat free riders, and incentives to the recycling chain.

Finally, the conclusions emphasize the success in incorporating principles of environmental regulatory quality in the São Paulo EPR implementation strategy. This fact strengthens the conclusions of previous research and suggests that its incorporation in policy design has the potential to overcome implementation gridlocks in complex environmental regulations.

Keywords: change management; environmental regulation; extended-producer responsibility; environmental agreements; sub-national environmental policy;

1. Introduction

Traditional regulation faces limits in dealing with contemporary environmental problems, highlighting the need to develop and apply new policy approaches (Fiorino, 2006). Additional hindrances occur in cases of complex regulations, in which resistance from the regulated community demands a “change management” from the environmental agencies (Mol et al., 2009). This transition is even harder in developing countries, where institutional fragility brings additional challenges for regulation to evolve (Ribeiro and Kruglianskas, 2015; OECD, 2016).

This paper presents a successful experience in how change management can overcome the hurdles of a complex new environmental regulation in a developing country. Adopting action research and the CATS model (Lewin, 1947) as methodological approaches, the study evaluates the experience of the São Paulo State Environmental Agency (CETESB), Brazil, to implement a sub-national extended-producer responsibility (EPR) policy.

After facing strong reactions from local industry to traditional regulation, the São Paulo government promoted a change management in the CETESB strategy, adopting previous research results (Ribeiro and Kruglianskas, 2015) to innovate policy design. The policy shift focused on replacing traditional “command-and-control” instruments by negotiated agreements, dissolving industry resistance to dialog and allowing a gradual pathway to more ambitious steps in EPR implementation (Ribeiro, 2015). According to official data (CETESB, 2019), in eight years the São Paulo EPR strategy has achieved significant results, motivating the actual investigation.

Thus, the aim of the present study is to understand how the change in management process occurred, and evaluate its critical factors (facilitators, barriers and opportunities), in order to help to build knowledge on the promotion of alternative policy in environmental agencies, mainly in developing countries.

2. Material and methods

This study was highly motivated and influenced by the active participation of one author in the change management process, acting as manager of the EPR area of São Paulo government from 2011 to the beginning of 2019. Considering this, the study adopted an “action research” (AR) approach as one of this methodology distinguishing characteristics is the active participation of the researcher in the diagnosis of a problem and in the development of a solution, in collaboration with the other members of the organization (Bryman and Bell, 2011). In order to establish an operational methodological model for the case study, the investigation adopted the “changing as three steps - CATS” model, developed by Kurt Lewin (Lewin, 1947).

2.1. The action research approach

As described by Lewin (1946), Action Research (AR) is “*a comparative research on the conditions and effects of various forms of social action and research leading to social action*”. AR is a way to develop and share experience between practitioners and other researchers, to improve strategies, practices and knowledge of the environments in which they practice (CCAR, 2019). According Eden and Ackermann (2018), AR is an obvious research method when the aim is to explore theory in relation to practice, providing robust evidence, with rigor and relevance, regarding a genuine need to take action, producing insights which cannot be gleaned in any other way (Eden and Huxham, 2006).

Generally, in AR the researcher is part of the process or organizational phenomenon that is the research focus, implying a position of privileged observer that both contributes to the effort and critically observes the specific aspects of his or her academic interest (Collis and Hussey, 2013). As different players can work together in different ways, AR can be organized in different arrangements. Some examples are (CCAR, 2019): “collaborative action research”, where the focus relies on the relationship of the practitioner with other researchers, establishing a balance of power and decision-making; “participatory action research”, which suggests a collaborative relationship with a team of practitioners, with each one doing their own research in order to obtain a multiple understanding of the problem; and “community-based action research”, when researchers listen to a community on how they want to proceed, giving voice to often marginalized groups (Freire, 1993).

Preset research uses the “action learning”, or “informal action research- IAR” (Beck, 2017). IAR does not have all the traditional AR features but maintains three fundamental aspects: it is conducted by practitioners, it is cyclical, and it is critical, questioning the way things are currently done (Beck, 2017). In fact, IAR focuses on the continuous learning aspect of AR (CCAR, 2019) but is not typically collaborative nor necessarily contains an explicit planning and systematic data-gathering (Beck, 2017). The present study fulfills these requirements but also can be considered as “contemporary action research” (Collis and Hussey, 2013), in which the focus relies on local and organizational factors that influence the studied phenomenon once it aims to extract lessons on the change management process, focusing on inspiring other innovations in the implementation of complex environmental regulations.

2.2. The CATS model - “changing as three steps”

According its general theory (CCAR, 2019), AR is basically conducted in successive rounds of studying the problem; planning action; taking action; collect and analyzing evidence; reflecting and sharing knowledge before starting the next cycle. The original model proposed by Lewin (1946) uses the idea of “*a spiral of steps, each of which is composed of a circle of planning, action and fact-finding about the result of the action*”. However, the present study used a later version of the method, known as the “change as three steps – CATS” model (Lewin, 1947), made up of the following three stages (Lewin, 1947; 1958):

- Stage 1 - Unfreeze: concerns getting ready for change, involving the creation of the necessary conditions and preparation for change, from an impasse situation previously created. Begins with the understanding and recognition of the need for change and includes diagnosis, data gathering and planning for action, preparing to move beyond the comfort zone existing in the balance of forces before the change;
- Stage 2 - Change: is where the real intervention occurs, altering the status quo, i.e., the action, the transformation or the change in fact. It could include action-planning and tests of new models of behavior, and eventually its feedback can alter previous planning in a learning process. For Lewin (1947), change is understood as a transition process, a movement made by organizations in response to specific interventions, rather than an isolated event; and:
- Stage 3 - Refreeze: represents a new equilibrium of forces, a stable situation after change, through actions and measures that get them accepted. Once this occurs, the new situation turns into a standard, and becomes perennial. This stage demand another round of data gathering, to evaluate new behaviors and relationships between actors, which may take time to happen. Minor adjustments can create feedback for Stage 2, and finally major adjustments can led to a new AR cycle.

The CATS model represents a structured sequence of steps to implement IAR, once each CATS stage can be associated to an AR step: the planning and awareness at the "unfreeze"; the action at the "change"; and the result and fact-finding through the "refreeze" (Lewin, 1958). In the following, Figure 1 summarizes the CATS method stages.

Figure 1: CATS methodology stages (based on French and Bell, 1973; Lewin, 1958)

2.3. Model application and data sources

The present paper applies the CATS model to investigate the “change management” in the São Paulo EPR implementation. For the study, the transition to a new regulatory approach, based on negotiated agreements, covering the period from May, 2011 to December, 2018 was considered to be the “change”.

To apply the CATS model, the "unfreeze" was understood as the opening to dialog, the substitution of the former situation, when there was the impasse and resistance from industry. The “change” stage began with the enactment of a new rule (Resolution SMA 38), in August 2011, which started the agreement negotiations. The "Refreeze” stage began with the publication of the *São Paulo Waste Management Masterplan* in October 2014, aiming to perpetuate the change.

Besides bibliographic references, used mainly to define the conceptual framework of EPR and the context of EPR in Brazil, data gathering for the case study included different sources of evidence. For the “unfreeze” an analysis conducted by CETEB technical staff on the quantity and quality of the EPR proposals received in 2011 was incorporated as a *proxi* to evaluate industry responses to the preparation for change. The "change" stage used primary data from the São Paulo state government, mainly CETESB documents, besides information directly provided by the person responsible for each of the EPR programs. The "Refreeze" stage considered the incorporation of EPR strategy in the São Paulo State Solid Waste Masterplan (SMA, 2014), as well as other official information about CETESB measures to advance EPR implementation.

Finally, case study discussion was twofold. First, the discussion on the occurrence of change in management adopted the "principles of environmental regulatory quality" (Ribeiro and Kruglianskas, 2015) as a conceptual framework. Secondly, to reach the aim of identifying and discussing the critical factors of the change management, the researchers used an evaluation process carried out between 2014 and 2015 (the end of the "change" and the planning of the "freeze" stage), with the person responsible for each of the EPR systems. The process included individual interviews and an open questionnaire, asking about facilitators, barriers and opportunities for improvement.

3. Extended Producer Responsibility (EPR) concept and experiences

Extended-producer responsibility (EPR) is an environmental strategy in which the responsibility of producers (manufacturers and importers) of a defined product set is expanded beyond manufacturing, mainly involving the management of waste generated after the end of their lifetime, including packaging.

As a policy instrument, it has two aims: transferring part of the responsibility of waste management from municipalities to producers; and providing incentives to incorporate environmental criteria into product design (OECD, 2016). Evaluations of existing EPR programs (OECD, 2014; 2016; Deloitte, 2014) show that since the 1990s they have helped to make significant improvements in waste management, improving recycling rates, diminishing landfilling, and reducing government spending. However, there is yet no perception of the impact on product design (Börkey, 2015).

In order to accomplish legal EPR requirements, producers have organized Producer Responsibility Organizations - PRO (OECD, 2016). The characteristics and configurations of PROs vary according to the country and the product but, in general, they have the role of managing all the system structuring and operation, including fee collection and data reporting to authorities (Deloitte, 2014; OECD, 2014). The first EPR systems emerged in Germany during the 1980s and according to OECD (2014), there were 384 different EPR regulations in the world, 70% of which appeared after 2001. In terms of the regulated products, most of them target electro-electronics (35%), tires (18%), packaging (17%) or end-of-life vehicles (12%). The remaining 18% distributes between other waste streams such as lubricating oils, batteries, graphic paper, and agrochemicals packaging.

Notwithstanding this growth in EPR, implementing these requirements in terms of environmental regulations still poses many challenges, and each region or country has developed particular arrangements. In Europe, regarding regional differences, European Directives guide a general strategy, and most countries already have their own regulations in place. In North America, Canada recently approved a national EPR policy, although some provinces already had previous regulation. The US does not yet have a federal EPR rule, but there are more than 70 statewide programs in operation. In Latin America, some countries have started their strategies (Brazil, Chile, Argentina, Colombia, and Mexico) but yet with few practical results. On the other hand, in Asia and Oceania there are significant variations between EPR implementation stages, with a few mature (Australia, Japan, and South Korea), some in implementation (China, India and Indonesia) and others still in discussion (Malaysia and Thailand). Finally, in Africa, the only reported case of EPR policy is South Africa, with low expectations for other countries (OECD, 2016).

EPR programs have been object of growing research, with notable increases in publications over the last five years. Some studies evaluate general aspects, e.g. defining recommendations for non-OECD countries (Manomaivibool, 2009), evaluating institutional arrangements (Fleckinger and Glachant, 2010), comparing policy instruments (e.g. Chang et al., 2019; Peng et al., 2018; Caiado et al., 2017), identifying challenges and drivers (e.g. Niza et al., 2014). There is a clear focus on specific waste streams (e.g. Niza et al., 2014), with case studies dedicated to a defined geographical coverage (e.g., Rubio et al., 2019; Park et al., 2018). Among the different waste streams, studies on waste of electro-electronic equipment - WEEE are most frequent (e.g. Rubio et al., 2019), with the dominance of studies on Asian countries and especially of China. Those focus on general program evaluations (Cao et al., 2016), improvement proposals (Gu et al., 2017), evaluation of different logistic models (Wang et al., 2017), and comparison with other countries (Awasthi et al., 2017. Salhofer et al., 2016). Important research has also been made in India, describing systems (Garlapati, 2016), evaluating legislation (Pathak et al., 2017) or identifying success factors (Mangla, 2016). Other developing countries with research on EPR of WEEE are Brazil (Demajorovic et al., 2016), Malaysia (Khor et al., 2016; Khor and Udin, 2013), South Korea (Rhee, 2016; Kim and Mori, 2015), Turkey (Karaağaç et al., 2017), Thailand (Chaowanapong et al., 2018), Pakistan (Umair et al., 2016), Mexico (Guevara-Garcia and Montiel-Corona, 2012), and the African continent (Schuluep, 2012). There are also some comparative studies among developing countries (Ikhlayel, 2018) and BRIC countries (Ghosh et al., 2016). Other waste streams are also covered by research, such as used tires (e.g. Banguera et al., 2018; Park et al., 2018; Milanez and Buhrs, 2009), but in very lower numbers than for WEEE.

A review conducted during the present study failed to find any investigation of change management in environmental agencies to implement EPR. However, there are a few studies focusing on a country's (or region's) EPR policy approach (e.g. Ludhiana, Martin and Rice, 2017; Niza et al., 2014; Nash and Bosso, 2013). For developing countries, such studies are scarcer (Cetrulo et al., 2018), evidencing a knowledge gap that the present study aims to help to fill.

For the present paper, it is worth mentioning the conclusions of Park et al. (2018), who studied EPR in Chile, arguing in favor of ensuring flexibility on how to attain solid but feasible EPR targets as a means to guarantee policy effectiveness. Another important contribution comes from Nash and Bosso (2013), who studied state-level EPR solutions in the USA, and although they recognize the power and benefits of federal action, they point out that sub-national regulation can act as an effective way to reach more rigorous and comprehensive EPR policies, innovating in product policy and reflecting local needs and conditions. Wagner (2009) draws the same conclusion, specifically on the WEEE program for the state of Maine, USA. Specifically on the solution pathway used by São Paulo state EPR policy, Silveira and Chang (2010)

highlight the advantage of negotiated agreements such as an instrument to promote more ambitious EPR policies. Lodhia, Martin and Rice (2017) also suggest adopting agreements as a way to establish recycling targets.

Regarding EPR research in Brazil, in the present study we must mention results from Milanez and Buhres (2009), who show the importance of new institutional arrangements to develop EPR policy, an aspect also emphasized by Guarnieri, Camara e Silva, and Levino (2016), and more authors in other countries, e.g. Ikhlayel (2018). On the other hand, Caiado et al. (2017) identifies challenges for EPR evolution in Brazil, mainly the absence of a legal factor that structures reverse channels and economic mechanisms to encourage and enable reverse flow management. Jabbour et al. (2014) presents the implementation of the national solid waste policy as a social and economic opportunity but believes that its success depends on overcoming certain challenges such as the need to coordinate efforts between producers, importers, retailers, government and civil society. In addition, international research on EPR implementation in developing countries (Börkey, 2015; Eeman, 2015) reports on common challenges, mainly: institutional difficulties and reduced infrastructure, including frequent irregular disposal practices, weak enforcement capacity by governments, great numbers of free riders, lack of or insufficient treatment and recycling alternatives, low rates of selective collection, lack of economic instruments (such as a landfill taxes), and the considerable presence of an informal sector.

4. The context of EPR implementation in Brazil

EPR systems regulation have existed in Brazil for some products (tires, lubricating oils, pesticide packaging and batteries) since the 1990s, with some more or less structured programs running since then. However, in 2010 the enactment of the National Solid Waste Policy (NSWP) brought a new playing field not only to EPR but to waste management in general. For the purposes of this study, a central aspect was the introduction of the "shared responsibility", defined as the "*set of individualized and linked attributions of manufacturers, importers, distributors and traders, consumers and public service providers (...) to minimize the volume of solid waste and (...) to reduce the impacts on human health and environmental quality*" (Brazil, 2010a). Besides, NSWP determines that manufacturers, importers, distributors, and traders "*are obliged to structure and implement reverse logistics systems, by returning products after use by the consumer, independently of the public service (...)*" for: pesticide packaging, batteries, tires, lubricating oil, fluorescent lamps and electro-electronic products. Additionally, the law provides the extension of these requirements to other products, including plastic, metal and glass packaging – as "general packaging" (Brazil, 2010a). This concept differs from the traditional internationally applied EPR definition, but despite the conceptual differences the present paper uses the term "EPR" for this NSWP requirement.

To detail each product or packaging EPR implementation, the NSWP decree (Brazil, 2010b) establishes three options: sectorial agreements (SA), broad covenants negotiated with all stakeholders, requiring viability studies, consensus and public consultations; terms of commitment (TC), simplified agreements signed between public authorities and business entities; or direct regulation.

Another distinguishing characteristic of the Brazilian NSWP is the recognition of the importance of waste pickers in municipal solid waste systems (MSWS), promoting their social inclusion through cooperative arrangements (Rutkowski and Rutkowski, 2015). Waste pickers are present in many places, mainly in developing countries, as part of informal waste management systems (Wilson, Velis and Cheeseman, 2006), as in South Africa (Simatele, Dlamini and Kubanza, 2017), Pakistan (Masood and Barlow, 2013), China (Fei et al., 2016), Nicaragua (Hartman, 2018), Chile (Navarrete-Hernandez and Navarrete Hernandez, 2018), and others. Some studies compare their situation between different countries, such as Wilson et al. (2009), who includes the Philippines, India, Pakistan, China and Nigeria. Brazil has a long tradition of active waste pickers although a significant change has occurred in the last three decades, mainly after the NSWP enactment. The NSWP specifically indicates the need to carry out the social inclusion of waste pickers as part of the systems implemented by both municipalities and responsible EPR and allows municipalities to hire cooperatives without a bidding process, among other initiatives (Beecheno, 2013). These requirements have created a unique experience in Brazil as a huge attempt to guarantee social sustainability (Rutkowski and Rutkowski, 2015).

Since the NSWP enactment, many researchers have studied different aspects of the inclusion of waste pickers in Brazilian MSWS, such as case studies of specific cities, identifying challenges and opportunities (e.g. Ibáñez-Forés et al., 2018; Ferreira, Barros and Soviar, 2017) and the importance of cooperative networks (Tirado-Soto and Zamberlan, 2013). An interesting contribution is the work of Rutkowski and Rutkowski (2015), which compares the experience of 25 Brazilian cities in incorporating waste pickers as part of the formal MSWS. Their conclusions on the potential effect of waste pickers prevision in the NSWP follows the results of Navarrete-Hernandez and Navarrete-Hernandez (2018), who shows a strong

correlation between governmental support and cooperative performance. This regulatory architecture seems to be rather better than other more liberal options, which have led to undesirable social consequences, as mentioned by Hartmann (2018). Besides, all of these studies recognize that in Brazil waste pickers are responsible to almost all MSW selective collection, and improvements in these arrangements are fundamental to increase recovery rates and the overall EPR performance (Tirado-Soto and Zamberlan, 2013), so EPR proposals for “general packaging” should include the support for waste picker cooperatives.

In terms of the EPR implementation at federal level, since 2010 the Brazilian Ministry of the Environment has organized thematic discussion groups, elaborated technical and economic viability studies, and issued calls for proposals for the sectorial agreements for five categories: lubricating oil packaging, medicines, general packaging, fluorescent lamps and electro-electronics. However, by the end of 2018, the federal government managed to sign only three of these: lubricating oil packaging, general packaging, and fluorescent lamps, highlighting the challenge in implementing the new legislation through agreements (Brazil, 2019).

5. The Case Study: Change management in São Paulo EPR implementation

Even before the promulgation of the NSWP in 2010, the São Paulo government was under pressure to move EPR implementation forward, due to the existence of former local policies (São Paulo, 2006). Thus, in 2010, the Secretariat for the Environment (SMA) published a first rule, listing products and packaging subject to EPR with specific requirements. This regulation raised great resistance from industry, creating a stalemate and leading to the postponement of the enforcement of the regulation until the next administration (Ribeiro, 2015).

At that time, many business leaders did not recognize the legality of the new responsibilities, questioning the law itself. Others acknowledged their responsibilities but did not agree to negotiate with the state government as they had already begun a federal negotiation (Ribeiro, 2015). These difficulties prevented EPR advancing, and the prospect of prosecutions caused the government to avoid enforcing the law in a coercive way, creating a gridlock in the policy implementation.

One month after the NSWP promulgation a new state government mandate began, defining waste management as a priority. Thus, in order to “unfreeze” the industry’s resistance, the CETESB technical team proposed a management change to radically advance the EPR strategy. The proposal took as a conceptual reference the “*principles of environmental regulatory quality*” (Ribeiro and Kruglianskas, 2015), which suggest the regulation be: decentralized, focusing on regional implementation parallel to the federal; participatory, through the stakeholders’ inclusion in the regulation design; flexible, providing freedom for regulators to define how goals would be met; preventive, favoring the EPR strategy to increase recycling targets; multi-instrumental, adopting agreements beyond command and control; gradual, with incremental goals; and reflexive, adjusting the strategy as it evolves (Ribeiro, 2014).

Following these principles, the government set a long-term strategy, consisting of three phases. The first, from 2011 to 2014, focused on creating a dialogue environment for negotiation, beginning with the existing systems (regulated before 2010), and then gradually extending to new EPR programs. The second phase, starting in 2015, aims to expand the scope of TCs, with more ambitious targets, prevention of free riders and inclusion of other stakeholders such as retailers and municipalities. Phase three, scheduled for 2021, will consolidate these advances in a review of the *State Solid Waste Policy* (CETESB, 2019).

5.1. The “Unfreeze” stage: creating openness to dialog

To unfreeze industry resistance, SMA repealed the former rule and opened a direct dialogue with regulated companies, aiming to negotiate firm agreements - the Terms of Commitment (TC), suggested by NSWP but not yet used (Ribeiro, 2015). To formalize the strategy, in August 2011 the São Paulo government enacted Resolution SMA 38 (SMA, 2011), which ask regulated companies to submit proposals on how to fulfill EPR requirements, creating a pathway for the change process. Resolution SMA 38 also named the products and packaging under EPR requirements: automotive lubricating oil; vegetable oil; automotive lubricating oil filters; automotive batteries; portable batteries; electro-electronic products; lamps containing mercury; tires; general packaging; pesticides packaging; and lubricating oil packaging (SMA, 2011).

SMA established channels of communication with industry, responding to more than two hundred direct consultations, and held two public hearings with about 500 participants. In addition, the government initiated direct negotiation with the main industrial associations, with 57 technical meetings coordinated by the state secretary himself (Ribeiro, 2015). These actions unlocked the existing impasse, prompting

companies and their representative entities to retake EPR implementation. As a result of the “unfreeze”, SMA received 199 proposals for EPR systems, both collective and from individual companies, including more than three thousand companies, distributed among the regulated products and packaging according Table 1 (Ribeiro, 2015).

Table 1: EPR proposal distribution (Ribeiro, 2015)

SMA conducted an evaluation on how each proposal attended Resolution 38 requirements through a four-level scale (totally comply, partially comply, fairly comply, non comply) with eight criteria: identification of participants, products covered, system description, assignment of responsibilities, inclusion of other participants, communication plan, targets and schedule. The results gave each proposal a final grade: good, moderate, regular, or insufficient. Figure 2 shows the distribution of proposals according their quality.

Figure 2: Quality distribution of proposals (#,%) (Ribeiro, 2015)

5.2. “Change” stage: Establishing negotiated agreements

Using the score of the proposals evaluation SMA selected the most relevant to open a dialog, envisioning the establishment of one Term of Commitment (TC) for each type of product or packaging. The negotiation process began in November 2011, and until the end of 2014 SMA and CETESB had signed 14 TCs with industry representatives, including more than 10,000 companies (Ribeiro, 2015). Due to particularities of each case, the agreements were signed in a different timeframe, between February 2012 and April 2014. After the establishment of each TC, CETESB monitored the system through periodic meetings and annual reports. It is important to mention that the process of establishing and renewing the TC continues permanently, in parallel with the further actions described in this paper.

In order to evaluate the “change” stage, the present study analyzed the success in TC establishment. Table 2 compiles quantitative data for each system under TC until 2016 (last available result). Values show the evolution both in terms of infrastructure (number of collection points or attended municipalities) and collected waste (tons per year). The compilation of data encountered some challenges, due to different reporting periods, different units of measurement, and other reporting issues adjusted during the period.

Table 2: São Paulo state EPR system operational results (CETESB, 2019)

Results in Table 2 varies greatly, mainly due to differences in the challenges presented for each product or packaging EPR (depending on each material market value, for example) and the circumstantial differences between systems (scope, maturity level, finances, etc). In addition, CETESB cancelled some TCs, while others were outdated and have not been renewed, so some results are not available for the whole period. Specifically for fluorescent lamps, SMA and CETESB decided not to establish a new TC since there is a nationwide federal agreement.

Another important initiative at the change stage was the enactment of a rule named DD 120 (CETESB, 2016), a specific regulation of some EPR systems aspects, such as simplifications for environmental permits for collection points and waste picker cooperatives, in response to private sector requests. This rule also provides reducing requirements for transportation and storage of electro-electronic waste, reducing not only the bureaucracy but also the costs of the respective EPR systems.

5.3. The “Refreeze” stage: making EPR strategy perennial

Based on the experience of negotiating the TC, a first proposition to perpetuate EPR strategy was the inclusion of a specific goal, with five actions, in the *São Paulo State Waste Management Masterplan* (SMA, 2014), a governmental commitment for the next twenty years, to be updated every four, as indicated in Table 3.

Table 3: EPR implementation targets in the São Paulo State Waste Masterplan (SMA, 2014)

A second initiative to advance EPR implementation was the replacement of Resolution SMA 38, evolving the "call for proposals", to a new rule, named Resolution SMA 45, which effectively introduced the obligation to implement EPR systems (CETESB, 2019). Resolution SMA 45 (SMA, 2015), promulgated in June 2015, reiterates the list of products under the EPR, adding "home, expired or obsolete medicines" and establishing that all TCs should be renewed with new targets. In order to comply with these determinations, a new negotiation effort began. As a result, some TCs were renewed and others signed, reaching 10 TC in effect by the end of 2018, attending to the first Masterplan target.

One important aspect to highlight, regarding the third masterplan target, was the inclusion of retailers in three of the renewed TCs: automotive batteries, portable batteries, and electro-electronic products. At the end of 2018, discussions were still taking place to include retailers in other TCs, as well as to include importers and municipalities in some of these systems (CETESB, 2019).

However, the most ambitious issue of Resolution SMA 45 is the requirement that CETESB include EPR implementation as a requisite for environmental permitting. Corresponding to the second Masterplan target, it aims to prevent free riders, a frequent request from some TC participants, who refused to renew their commitments if the government did not guarantee making requirements from TC non-adherent enterprises (Ribeiro, 2015). Thus, recognizing the need for an isomeric application of EPR requirements, and after a long internal discussion, CETESB published a rule named DD 076 (CETESB, 2018), which defines details for EPR request in permitting, including quantitative targets, reporting requirements and other conditions. To demonstrate compliance, a "Reverse Logistics Plan" for each EPR system, followed by a "Yearly EPR Report" was requested to monitor results (CETESB, 2019).

In order to evaluate results from the "refreeze" stage of the strategy, the present study analyzed two main actions still in progress at the end of 2018: the TC renewal, and the inclusion of EPR as an environmental permitting requirement.

a. The TC renewal process

After the publication of Resolution SMA 45, CETESB altered the conditions to sign the TC and established new geographical and collection targets. As each case has its own peculiarities, some TCs were quickly renewed, while others were still under discussion at the end of 2018. Table 4 presents information on the renewal status of each TC in December 2018.

Table 4: TC renewal status in December 2018 (CETESB, 2019)

An important evolution during the TC renewal was the inclusion of retailers in three EPR systems. To this end, CETESB invited the *São Paulo State Retailers Federation - FECOMERCIO-SP*, an entity that represents 143 trade unions, which together account for 10% of Brazil's gross domestic product (FECOMERCIO, 2017), to join the negotiation. The first collaboration of this entity took place within a TC on "mobile phones" in 2013, and by December 2018 they had joined the TC on "portable batteries", "automotive batteries" and "electro-electronic equipment". Although envisaged, the involvement of importers and municipalities has not yet occurred systematically, limiting the scope of some of the systems.

b. Inclusion of EPR as an environmental permitting requirement

Although the agreement-based characteristic of the São Paulo EPR strategy, CETESB soon recognized the need to go further towards adding some enforcement aspect to reinforce policy results. Thus, it proposed to incorporate the most important enforcement instruments, the environmental permits, into EPR. To regulate details of this objective, mentioned first in Resolution SMA 45, CETESB published a specific rule, DD 076, in April 2018 (CETESB, 2018). This administrative order specifically defines which companies are the object of EPR, presents quantitative collection targets for each product or packaging, and provides other details such as the need to present a *Reverse Logistic Plan* and yearly reports to CETESB, for the period 2018-2021.

Since the DD 076 publication in December 2018, CETESB has taken many initiatives to operationalize it such as the definition of guidelines and forms to the *Reverse Logistics Plan*, responses to consultations and meetings for clarification. By early October 2018, the first DD 076 deadline, CETESB had received 51 *Reverse Logistics Plans*. After a first verification, eliminating double reporting and improving orientation to industry, they were reduced to 26 *Reverse Logistics Plans*, including 2,179 companies, which CETESB verified individually. It is worth mentioning that of these only 6 were from isolated companies, which shows the preference of companies for collective action. By November 2018, 13 of these Plans had been

successfully verified by CETESB, with or without reservations, and the other 14 had been returned for review or supplementation.

6. Case study evaluation and discussion of results

In order to attend to the research objectives, the case study evaluation unfolded in three steps. First, how change management occurred, using the most important "principles of environmental regulatory quality" as a reference was discussed. Secondly, the results of each CATS stage were presented, analyzing whether they fulfilled expectations. Thirdly, there was an evaluation conducted with each EPR representative bring new evidence to define critical factors in change management.

6.1. The occurrence of change management

As mentioned, the conceptual basis for change management was the "*principles of environmental regulatory quality*", proposed in a former study (Ribeiro and Kruglianskas, 2015). Based on the presented results, it was possible to evaluate how these principles behaved in strategy evolution, aiming to inspire future improvement in other regulations.

The first principle is "*decentralization*", represented by the regional approach adopted by São Paulo. The state obtained clear advances in the negotiation and practical implementation, with more successful results than the federal level. Other Brazilian states have developed their own regional EPR strategies, many of them following the São Paulo experience, and some with CETESB support, obtaining successful EPR programs through agreements. It seems evident that the regional approach has helped to consider socioeconomic differences, taking advantage of local characteristics, and enabling a more focused governmental intervention. However, policy success can be hampered if other states, or the federal government, fails to advance their own strategies, denoting a policy fragility.

Another aspect is the use of agreements as an environmental policy instrument, which make many principles feasible, such as the "*multi-instrumental*" approach beyond command and control. The use of negotiation with stakeholders was also an important means to facilitate the "*participatory*" principle as industries (and their entities) took part in the negotiation from its outset, which helped policy to come out of the impasse, guaranteeing the "unfreeze". Although some regulated companies refused to dialog before Resolution SMA 38, during the negotiation of TC these same companies recognized their responsibilities, proposing effective solutions, and, afterwards, complying with the law, in a clear evolution of corporative values.

The "*flexible*" aspect was another principle implemented by Resolution SMA 38, which called for proposals instead of directly regulating EPR requirements. Afterwards, the Reverse Logistic Plans, required by DD 076, reinforced this principle. Besides, granting each proponent freedom to propose their system allowed the government to test different EPR models in a real-world situation. The option to put the systems in place as quickly as possible, testing them as they are carried out, also reduced delays, avoiding extra costs and reducing uncertainties associated with the technical-financial feasibility studies. Still on the use of agreements, the "*gradual*" approach seemed to be a key factor for the strategy's success as the application of Lewin's CATS model demonstrated in the research results.

The "*reflexive*" nature of regulation was also accomplished by the use of agreements in a phased strategy. The evaluation process conducted in 2014-2015 helped to improve the strategy between the "change" and "refreeze" stages. As a side benefit of this process, there was an institutional learning about the EPR regulation, which has already led to improvements in the regulation design, as for example the update from Resolution SMA 38 to Resolution SMA 45, and furthermore the DD 076 design. A new opportunity has emerged from the DD 076 implementation, which is still to be verified.

A final principle is the "*preventive*" aspect. EPR alone is a precautionary approach as it defines obligations related to avoid environmental damage and, in many cases, it improves efficiency in the use of resources through the increase in reuse and recycling rates. In the present study, it was possible to observe a gradual increase in collection rates in many systems. However, although for the purposes of the strategy at the moment these numbers represent a significant advance, recycling rates in São Paulo state are, with rare exceptions, still far from what is desirable, denoting a great challenge still to be faced.

6.2. Discussion of the results of the CATS model

Considering "**unfreeze**" objective as to dissolve the impasse between government and industries to advance EPR, it is fundamental to evaluate industry response to Resolution SMA 38's "call for proposals". So, a first indicator of success was the immediate reaction of the companies, which, during the 60-day period

showed great interest in participating in the meetings promoted by SMA, fundamental for reaching the high number of proposals submitted in this short period. Based on the analysis of Table 1 and Figure 2, it is possible to verify a significant response from companies to Resolution SMA 38, showing its success in unfreezing the gridlock. The number of presented proposals (199), representing about 3,000 companies, denotes an overcoming (at least partial), of the previous resistance to comply. Concerning the quality of the proposals, only 11% were insufficient, which, at the time of the strategy, indicates that there was a significant effort by companies and entities to produce good (12%) or even moderate (22%) proposals.

Another important finding is that the proposals presented covered all products and packaging included in Resolution SMA 38, denoting a spread scope of the “unfreeze” effect. Besides, although most of the proposals came from companies, the quality check showed that the proposals from entities were, in general, of a much higher quality - especially in cases where EPR had previously been regulated (as for pesticide packages, tires, batteries and used lubricating oil). In most cases, proposals from companies were in fact part of the entities’ proposals, or documents that did not attend the minimum required content. This fact reinforces the literature’s (OECD, 2016) assumption that EPR implementation is better carried out collectively than individually. This evidence led to the perception that the main result of the “unfreeze” was the evolution from a reactive posture of companies to another, more propositional, position, demonstrating the success in the gridlock dissolution that prevented the advance of regulation. Proposal presentation, and especially good quality proposals, makes it evident that the scenario was prepared for the following “change”.

Regarding the “**change**” itself, according to Table 2 data, it is possible to verify that only three of the 14 TCs signed in the period 2011-2014 (referring to food packaging, fluorescent lamps and mobile phones), had zero or negative evolution. The others evolved positively and, in some cases, the evolution was quite significant, mainly for “general packaging”, “beverage packaging”, “vegetable cooking oil”, “packaging of lubricant oil” and “lubricant oil filters”. It is important to highlight that the four cases with the best relative evolution did not have any previous regulation, which suggests that the previously existing EPR systems already had reached a certain maturity, and, therefore, their percentage evolution is more challenging. In these cases, the systems remained stable (“pesticide packaging” and “lubricant oil”), had a slow evolution (“tires”) or evolved little in geographic coverage but more intensively in the quantity collected (“portable batteries” and “automotive batteries”). In these last two cases, it is interesting to note the greater evolution in collection probably occurs because regulation was already in place, but there was no established formal system until São Paulo regulation.

Notwithstanding the results mentioned above, the most significant effects of the process are the qualitative evolutions in the systems to overcome challenges that were only perceived as they began to be put into operation. In this sense, evolution occurred in three aspects. First, in the process governance, with the mobilization of companies, mainly around their entities, that took on the role of having a relation with the state government, and, in many cases, the system structuring and operation. In addition, evolution occurred in the evolution of dialogue, through the establishment of communication channels between private entities and government, increasing the progress that had been made in the “unfreeze”. Finally, the infrastructure improved, with the creation of new waste collection and treatment facilities and services, as well as new businesses in the recycling chain, perceived by the increase in consultations on the subject with the environmental agency. Among these aspects, it is interesting to note that the improvement in the systems governance has led many entities and companies to create Producer Responsibility Organizations (PRO). Until the enactment of the NSWP, these entities only existed for “pesticide packaging” and “tires”. With the EPR evolution, PROs were also created for “packaging of lubricant oil”, “portable batteries” (which later include “electro-electronic”) and “automotive batteries”. Due to a federal AS, a PRO was also created for “fluorescent lamps”. In December 2018 this tendency continued, with the intention to establish other PROs, confirming an assumption found in the literature (OECD, 2016).

In “**refreeze**” the most remarkable results came from TC renewals. An evaluation of Table 4 shows that six of the TCs signed between 2011 and 2014 were renewed, two were replaced by broader initiatives, and another incorporated by a similar one. In two cases of the five that were not continued (“fluorescent lamps” and “food packaging”), the decision came from CETESB as the system failed to fulfill its commitments. It is noteworthy that in the specific case of lamps, federal government signed a national wide agreement. Another TC, referring to “beverage packaging” reached its goals, but was not renewed due to CETESB’s decision to stop signing TCs with individual companies, although according to information from the company it is still in operation. Finally, two TCs (“tires” and “lubricant oil”) were still in negotiation in December 2018, searching for an agreement on the conditions required by the environmental agency. In addition, CETESB has signed three new TCs since 2014, for “sanitation products packaging” (new system), “electro-electronic equipment” (replacing that of “mobile phones”), and a second one for “general

packaging", with an alternative operational model. These new TCs also demonstrate the fulfillment of the strategy's continuity goal, showing that the strategy continued not only with the existing TC but has also expanded to recognize other systems.

Another important aspect is the inclusion of new participants (retailers), with two decisive aspects. The first is the very maturation of the retail business position. If the company underwent a change from a reactive to a propositional behavior in the "unfreeze" stages of the strategy, for retailers this process occurred later, and in a more timid manner. Two possible hypotheses to explain this difference in timing are the absence of compliance pressure, unlike in companies; and their own EPR concept, which makes its implementation an initiative more concerned with companies than retailers - which would justify the adoption in Brazil of the concept of EPR instead of "shared responsibility".

For the incorporation of EPR in permitting, it seems too soon to draw any comment. However, the high adherence rate of companies to the Reverse Logistic Plans denotes the apparent success of the strategy. Furthermore, the considerable prevalence of collective plans, in opposition to the situation of the former EPR proposals (presented in response to Resolution 38 in 2011), suggests some learning in companies, which could have noticed the benefits of collective systems. Moreover, it should be recognized that DD 076 represents the perennial aspect of the strategy since it links EPR implementation to a well-established and robust procedure. Besides, the defined time horizon for the strategy implicitly means a supposition that after this period the EPR implementation would have reached a certain maturity, allowing a new cycle of negotiation and legislation revision.

In summary, it can be seen that the strategy adopted for implementing EPR in São Paulo through negotiated agreements (TC), a central focus of the "change" has not only continued but has been extended to the "refreeze". This perception confirms that in the "freeze" there were important results in the action of the public power for the perpetuation of the improvements promoted in the "change".

6.3. São Paulo EPR implementation facilitators, barriers and improvement opportunities

From October 2014 to January 2015, CETESB conducted an evaluation of EPR implementation through interviews and questionnaires with those responsible for each of the EPR systems, asking them to identify facilitators, barriers and opportunities for improvement. These results were consolidated in an internal document (Yogi, 2015), available only in Portuguese, and were summarized by Ribeiro (2015). When comparing the answers, it is possible to verify that there are several common aspects between different systems, as presented below.

a. Case study facilitators

Figure 3 presents the consolidated results of the main facilitators identified in the study.

Figure 3: Main facilitators for the São Paulo EPR strategy (Ribeiro, 2015)

As Figure 3 shows, the most outstanding aspect highlighted by systems managers was the "governmental system recognition" (31%), obtained through TC success. According to these, this simple act in itself not only confirms compliance by TC participants but also manifests the government opening to dialog, fundamental to dissolve the previous impasse to advance regulation during the "unfreeze". Two entities declared that the disclosure of this recognition among companies collaborated to the "producers' recognition of EPR importance", acting as a strong facilitator of the process (10%), as it led to a great increase in the adherence to the system by their associated companies, collaborating to improve NSWP compliance.

Another mentioned facilitator (17%) was the "increase in system infrastructure", i.e., companies felt more confident to assume more ambitious growth rates during negotiations after the good results measured during the "change" stage. This positive feedback stimulated the continuity and expansion of the system, and four entities reported this facilitator perception, while three stated that they had risked accepting "overcoming of collection targets", as a facilitator (10%) to exceed these goals.

The perceived “generator behavior change”, both by companies and consumers, was also identified as an important facilitator (10%), which, according to three entities, can be measured by the increase in waste collection. Another facilitator was “data systematization” (7%) as some systems established information technologies that gave more material and financial control and facilitated information transparency.

Finally, other aspects also mentioned as facilitators (14% in total) were: the promotion of environmental education initiatives; the diverse activities carried out by CETESB to disseminate the strategy; the initiative by many industrial entities to direct collective system implementation; and the inclusion of EPR targets in the *São Paulo State Waste Masterplan*. In relation to this last aspect, it is worth mentioning that it confirms its value at the beginning of the “refreeze” as a first step in strategy perpetuation.

b. Case study barriers

Figure 4 presents the consolidated result of the main barriers identified in the study.

Figure 4: Main barriers for the São Paulo EPR strategy (Ribeiro, 2015)

The main aspect cited as a barrier to EPR implementation (26%) was the “low participation of producers, retailers and importers” - mainly the latter. This evidence comes as no surprise once it has been a fundamental concern of CETESB since the beginning of the strategy, having motivated some further actions in “refreeze” (such as DD 076 in the case of the companies, and the inclusion of FECOMERCIO-SP in the TC negotiation for the retailers). This could hamper general EPR implementation, but specifically has a strong negative effect when EPR systems are directed to include waste pickers as this kind of arrangement is still quite fragile, depending on the continuity of financial support.

Another barrier cited was the absence of a mechanism to prevent free riders, represented by a “lack of inspection of free-riders” (16%), which discourages companies to comply with the law. Two entities have quoted that this problem is not restricted to companies but also applies to retailers - which should be at least a partner for waste collection. One of the entities cited that not only does this lack of enforcement restrict TC participants but also causes participants to drop out, representing a risk of a setback in strategy.

The difficulties of including municipalities in the systems, specifically the “problems in municipalities’ covenants” was another mentioned barrier (16%). One specific challenge that justifies this barrier, at least in part, is the lack of consensus on how to accomplish the legal provision for reimbursement of municipalities in the cases where they operate part of the systems. At the end of 2018, this subject was still quite controversial, and in some cases ended up being the object of judicial disputes.

Another mentioned barrier was the “lack of recycling incentives” (16%), mainly tax differentiations since not only are there no benefits for the use of recycled materials but also there is a standard discounting the value-added tax of raw materials, which operates as a counter-incentive. The “low participation of generators” (11%) was also mentioned as a barrier to return the post-consumption waste to the systems. Although an improvement in the cultural and behavioral aspect within the strategy facilitators was identified, this tendency is not uniform among the different products subject to EPR. As a matter of fact, in many cases the generators have no interest in returning the waste, either because of operational difficulties (distance to the collection points, for example) or because there is an intrinsic value in the material (as in the case of some electronics, such as cell phones). In some specific cases, like “lubricant oil”, this value is so important that the creation of parallel market to the official systems was reported, collecting and selling the waste illegally. On the other hand, for some non-valuable waste (fluorescent lamps, for example), the “high system cost” was also mentioned as a barrier (11%). Finally, there were also mentions of “problems in source collection” (5%), mainly due to the difficulties encountered by the large distances between collecting points to recover small amounts of waste.

c. *Case study opportunities for improvement*

Figure 5 presents the consolidated result of the main improvement opportunities in the strategy identified in the study.

Figure 5: Main improvement opportunities for the São Paulo EPR strategy (Ribeiro, 2015)

Unsurprisingly, the identified opportunities for improvement of São Paulo EPR strategy were very much in line with the encountered barriers. The most commonly mentioned aspect was “increase the number of participants” (24%), especially municipalities (through standardized agreements) and retailers (as adherents to TC). Secondly, the need to “promote tax revision and incentives” focusing on EPR (19%) was mentioned. In some cases, the suggestions were very specific, citing which taxes could be changed and how. Among them there was a proposal to create a specific sales tax to finance the EPR systems (denominated as “ecovalue”, as in some European countries), which in addition to reducing costs and expanding systems would increase consumer awareness.

Another opportunity was to “orient the generator through environmental education programs” (9%). Three entities suggested the use of São Paulo's public school network, which includes 6 million students, for this end. Two other entities suggested that all stakeholders in the production and consumption chains should support these actions, mainly financially.

Curiously, the participants also suggested to “include EPR in the permitting process” (9%), as a form of improving EPR strategy (9%), which afterwards took place in the “refreeze” through the enactment of DD 076. Two entities stated that this would prevent free riders, allowing them to convince new companies to adhere to their systems. In fact “improve inspection of free-riders” (6%) was also mentioned as an opportunity, once it guarantee the environmentally adequate disposal of waste, besides protecting the competitiveness of those who operate systems. This fact corroborates the so-called “Porter Hypothesis” (Porter and Van der Linde, 1995), which could be a topic for further research.

“Create stimulus for recycling” was also mentioned (6%), not only in relation to tax adjustments, but also with government programs to attract investment and entrepreneurship in the recycling chain, including funds for research and innovation. In addition, “create infrastructure through covenants” between local government and enterprises was also cited as an improvement opportunity (4%), especially in the case of municipalities and municipal consortia, which could maintain collaborative collection points, offering scale and thus reducing costs for the systems. Two entities also mentioned the possibility of standard agreements for the installation of collection points in public places as a way to support the system's geographic expansion.

7. Conclusions

The present article has analyzed the experience of "change management" in the EPR strategy in São Paulo state, Brazil. The adoption of some "*principles of environmental regulatory quality*" has led to the development of a new EPR policy approach, which has already brought an important evolution and significant practical results.

Through the application of the "*changing as three steps*" (CATS) model developed by Lewin (1947) as methodological framework, it was possible to understand the process of change. Looking at the change process as a whole, the great challenge was the very fact of putting into practice a new complex environmental regulation, which brings new responsibilities and costs to many enterprises, and whose benefits are not always perceived. Thus, before the change management there was strong resistance from companies, claiming a "competitive imbalance" between São Paulo companies compared to those in other Brazilian states.

Research demonstrated a significant success with the promoted change. The “unfreeze” results showed that the regulation impasse was broken down, with companies responding very positively to the call for proposals by the government. Moreover, the strategy has flourished over the years, with the establishment

of agreements leading to the creation of new EPR systems and the extension of the existing ones, both in quantitative and qualitative results – mainly in the “refreeze”.

Evidence also highlighted a number of positive factors of the strategy, which acted as facilitators of the change in the management process. Among these, the central aspect was the companies’ own choice of negotiated agreements, due to the public recognition they gave to the systems, strengthening and stimulating their implementation. This approach favored compliance with the law by an increasing number of companies, and demonstrates the strategy’s success in inducing more perennial compliance.

However, as the study denotes, the use of negotiated agreements was not sufficient to prevent free riders, a complementary enforcement approach to strengthen the “refreeze” being fundamental. The solution adopted by São Paulo, linking EPR requirements to the permitting process, follows one of the identified opportunities for improvement and initially seemed to be successful. Nevertheless, it is too soon to talk about the success of the program, and the authors strongly recommend a further dedicated investigation when more results from DD 076 are available.

On the side of the identified barriers, the most crucial challenge is the enlargement of the EPR systems, mainly through the inclusion of new participants in the TC, specifically retailers and municipalities. To make advances here, participants cited important opportunities such as the establishment of standard agreements, including a prediction of future compensation for operating part of the systems. Another important facilitator was the feedback on the success in increasing the systems geographic coverage, even if the long distances to cover appears as a barrier. Evidence shows generators (companies and consumers) have changed their behavior and are already acting as facilitators although there is a significant opportunity for improvement with environmental education programs. It is important to note that this perception is not distributed equally among all products, and there are still great difficulties for the government to negotiate more ambitious targets, especially when waste materials do not have significant market value to alleviate the high operating systems costs.

For the transition from the “change” to the “refreeze”, the study demonstrated the need to have included specific targets for EPR in the *São Paulo State Waste Masterplan*, as a way of politically declaring intentions to continue the strategy. As demonstrated, efforts to implement these goals were still the basis of the strategy’s progress in December 2018, and CETESB is still facing the challenge of the “refreeze” strategy. Another possibility, not yet explored by the São Paulo government, would be the implementation of the last target envisaged in the Masterplan - referring to the prohibition of sale in São Paulo of products subject to EPR requirements without a demonstration of EPR. This prediction, although quite ambitious, would allow the strategy to be intensively perpetuated, with a broader compliance than the present one. However, a legislative update would be necessary, which is expected to be possible only after 2021.

Finally, research suggests that the incorporation of the “*principles of environmental regulatory quality*” as part of the “unfreeze” prove to be a positive factor for the success of “change management”. Besides the importance for the present study, this assumption allows two other findings. First, it confirms the importance of the “principles” themselves, reinforcing the results and the practical application of the previous research (Ribeiro and Kruglianskas, 2015). Secondly, the research corroborates the use of the CATS model to evaluate the change management process in contexts much broader and more complex than those in which it has been developed and applied (internal groups of organizations).

Nevertheless, although significant results emerged from the present study, they should be considered with care when designing new change management in other conditions. Due to the inherent complexity of environmental problems, the success of a regulatory change management greatly depends on the specific problem by which it is driven, besides the particular context and institutional scope. In the specific case study some important local characteristics seem to collaborate with the positive results, mainly the favorable legal environment created after the enactment of NSWP. Furthermore, specific political convergences ensured some degree of support to promote technical staff proposals, as can be noted when the government applied research results to design the new regulation, or when CETESB managed to propose DD 076. This kind of situation is rarely perceived in developing countries, and it was probably decisive in the success of the present case study.

As a theme for future research, it is recommended to keep on tracking São Paulo EPR strategy results, mainly to evaluate the effects of including EPR requirements in the permitting process. In the same way, it would be of interest to study other similar experiences, either from other Brazilian states and the federal government, or from other countries with similar realities, in order to compare results of different “change management” strategies for similar impasses found in the present case.

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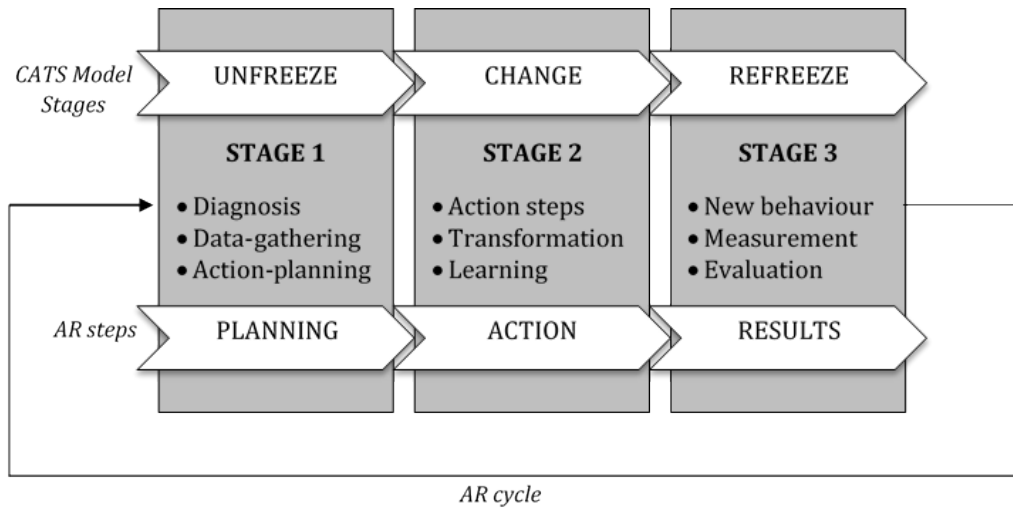


Figure 1: CATS methodology stages (based on French and Bell, 1973; Lewin, 1958)

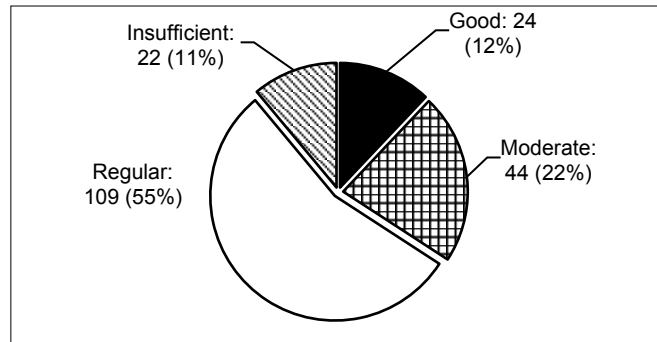


Figure 2: Quality distribution of proposals (#,%) (Ribeiro, 2015)

Journal Pre-proof

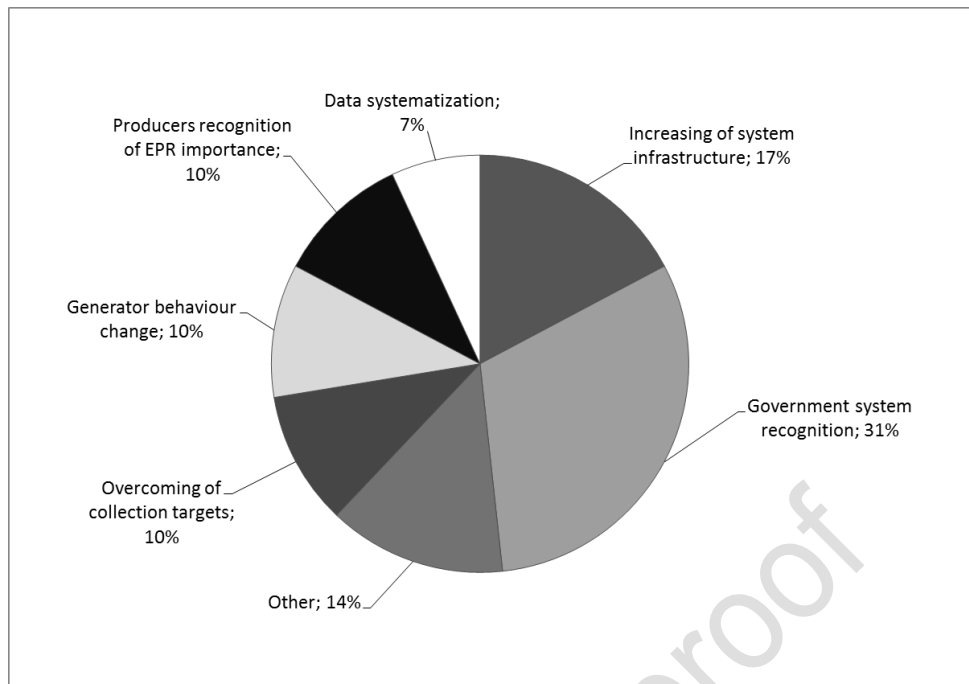


Figure 3: Main facilitators for the São Paulo EPR strategy (Ribeiro, 2015)

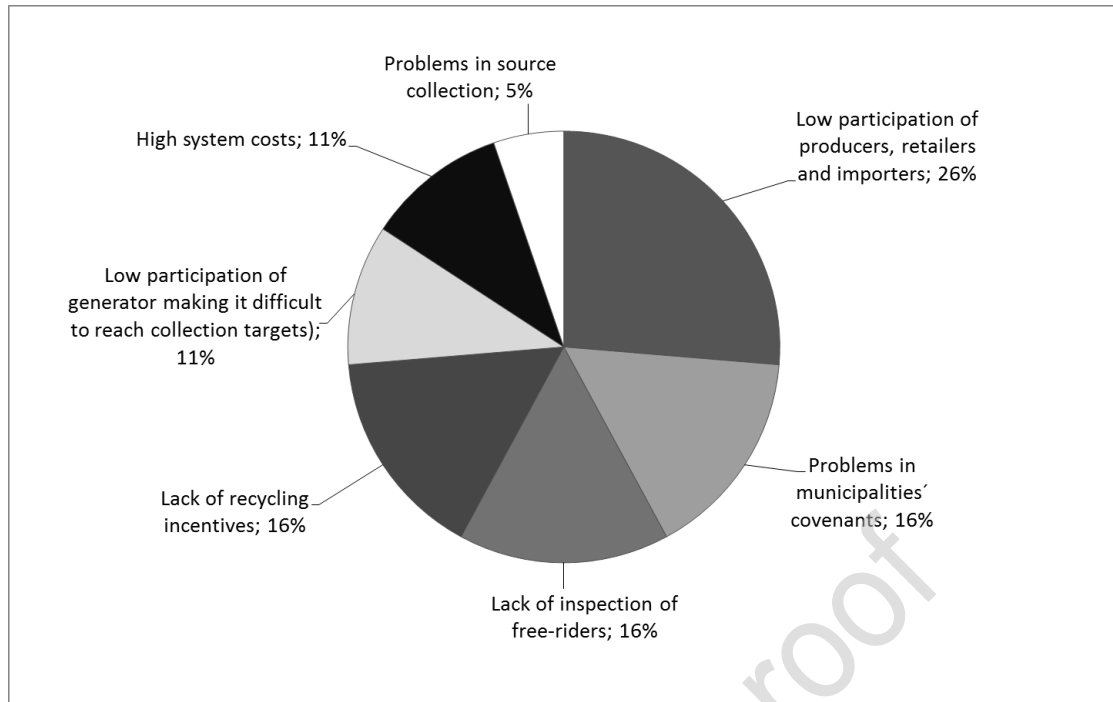


Figure 4: Main barriers for the São Paulo EPR strategy (Ribeiro, 2015)

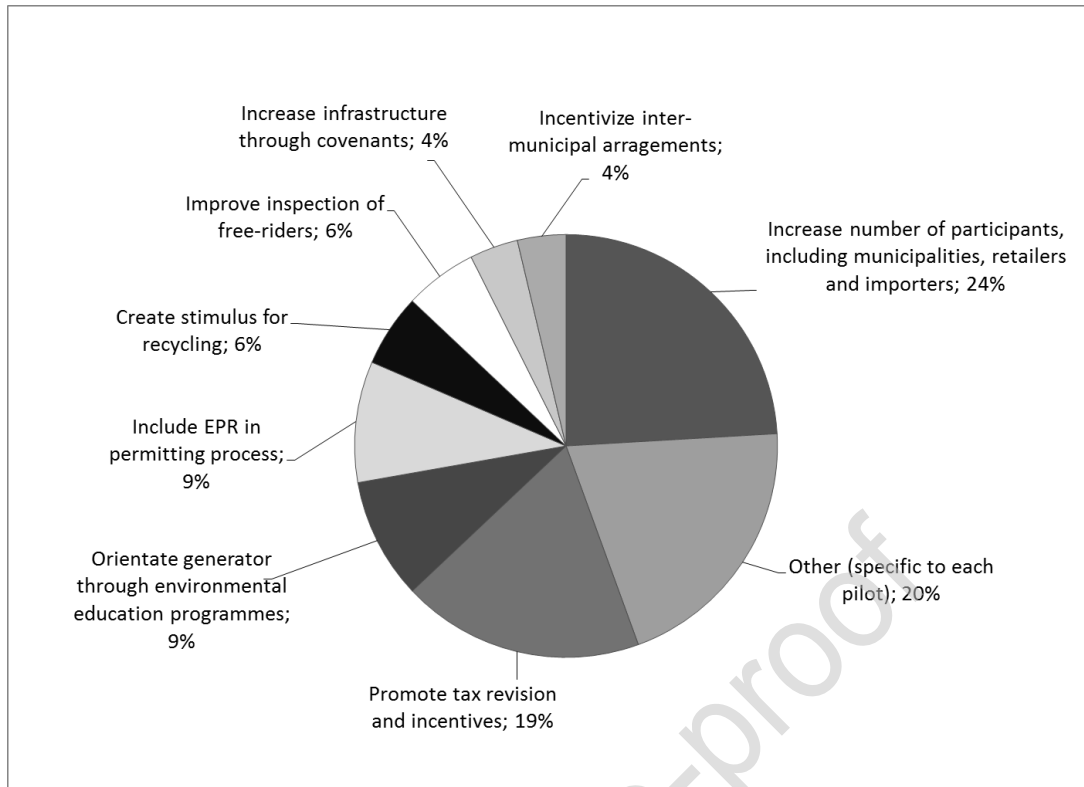


Figure 5: Main improvement opportunities for the São Paulo EPR strategy (Ribeiro, 2015)

Table 1: EPR proposal distribution (Ribeiro, 2015)

Sector	Proposals from Associations	Proposals from individual companies	Total
Automotive lubricant oil	1	7	8
Vegetable food oil	1	0	1
Automotive lubricant oil filters	1	10	11
Automotive batteries	2	11	13
Portable batteries	1	19	20
Consumer electronics products	4	55	59
Lamps containing mercury	1	1	2
Tires	2	7	9
General packaging	31	39	70
Pesticides packaging	1	0	1
Automotive lubricating oil packaging	2	3	5
Total	47	152	199

Table 2: São Paulo state EPR system operational results (CETESB, 2019)

PRODUCT / PACKAGING	Infrastructure evolution (number of collection points or attended municipalities)					Waste collection evolution (t/year)				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
Supporting waste pickers entities / selective collection										
General Packaging ¹	17 municipalities	23 municipalities	34 municipalities	38 municipalities	TC outdated	n.a.	3,906	31,306	38,663	TC outdated
Food Packaging	Diagnosis only	0 ²	TC cancelled			0	0	TC cancelled		
Beverage Packaging	n.a.	n.a.	2 municipalities	7 municipalities	4 municipalities	n.a.	n.a.	n.a.	4.13	10.09
Establishment of specific collection points										
Pesticides Packaging	76	76	76	73, plus 66 itinerant points	n.a.	4,528	4,769	4,815	4,656	4,583
Tires	238	239	242	252	n.a.	179,900	182,350	191,400	188,100	n.a.
Portable Batteries	557	596	626	604	600	76	158	87	99.7	73.04
Mobile phones	1,487	1,344	n.a.	n.a.	n.a.	51.7 ³	44.7 ³	23.5 ³	7.25 ³	n.a.
Vegetable Cooking Oil (individual)	305	368	410	478	n.a.	124.2 ⁴	186.8 ⁴	207 ⁴	252 ⁴	n.a.
Vegetable Cooking Oil (assoc.)	n.a.	908	950	1150	1291	n.a.	1,029.5 ⁴	1,048.8 ⁴	1,015.7 ⁴	1,069 ⁴
Itinerant collection										
Packaging of Lub. Oil	6,249	7,662	8,000	9,751	10,108	290	623	914	1,120	938
Lubricant Oil	n.a.	n.a.	n.a.	n.a.	n.a.	112,549 ⁵	122,597 ⁵	111,081 ⁵	108,794 ⁵	n.a.
Lubricant Oil Filters	689	673	959	920	1,134	136	277	477	497	601
Automotive Batteries	28	33	35	34	n.a.	5,183	8,820	8,194	8,467	n.a.
Fluorescent lamps	n.a.	TC cancelled	n.a.	n.a.	n.a.	n.a.	TC cancelled	n.a.	n.a.	n.a.

n.a.: not available (generally before TC signature, beginning of system operation or after TC expiration)

1: System starting to operate in July/2013

2: Company sold

3: Estimated (different reporting periods and unit of measurement)

4: Calculated using density of 0.92 kg/l

5: Calculated using density of 0.89 kg/l

Table 3: EPR implementation targets in the São Paulo State Waste Masterplan (SMA, 2014)

Action in Masterplan	Deadlines
Continue TC establishment	Continuous activity
Regulate EPR for companies not adhering to TC	2015 to 2018
Include retailers and importers in EPR strategy	2015 to 2018
Discuss the inclusion of new products in the EPR regulation (mainly agricultural equipment and utensils)	2020
Restriction on the sale of products not associated with EPR programs	2025

Table 4: TC renewal status in December 2018 (CETESB, 2019)

PRODUCT / PACKAGING	Date of first TC signature	Status	Date of renewal
Supporting waste picker entities / selective collection			
General Packaging	February, 2012 (added on August, 2013)	Renewed	October, 2018
Food Packaging	June, 2013	Not renewed	-
Beverage Packaging	April, 2014	Not renewed	-
Establishment of specific collection points			
Pesticides Packaging	February, 2012	Renewed	December, 2015 (added on October, 2018)
Unserviceable Tires	June, 2012	Not renewed	-
Portable Batteries	February, 2012	Renewed	December, 2016 (added on December, 2017)
Mobile phones	June, 2012	Substituted by a TC on Waste of Electro-Electronic Equipment	October, 2017
Vegetable Cooking Oil (individual)	June, 2012	Incorporated by the association TC	-
Vegetable Cooking Oil (assoc.)	December, 2012	Renewed	December, 2015 (added on December, 2017)
Itinerant collection			
Packaging of Lub. Oil	February, 2012	Renewed	December, 2016 (added on October, 2018)
Lubricant Oil	June, 2012	Not renewed	-
Lubricant Oil Filters	December, 2012	Renewed	December, 2015 (added on October, 2018)
Automotive Batteries	December, 2012	Substituted by other TC	December, 2016
Fluorescent lamps	January, 2013	Not renewed	-