Environmental Management System for Small Business

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Research

Keywords: upholstery, environmental impacts, remanufacturing, environmental management system

Posted Date: October 21st, 2021

DOI: https://doi.org/10.21203/rs.3.rs-970673/v1

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Abstract

The upholstery remanufacturing service is an activity that provides for the sale of products that contain reused items, extending their lifespan. The objective of this study is to propose a simple and feasible Environmental Management System (EMS) for small businesses, particularly, for the upholstery company sector. The implementation of the existing EMS standards is hampered by the lack of elements in the upholstery companies. Thus, the implementation of an EMS is still far from the reality of these small enterprises. Visits were made to twenty-eight upholstery companies in Teresina, Piauí, Brazil, to get to know the sector and accompany the production process, as well as observing the activity's environmental aspects. The EMS standards do not meet the needs of small businesses, however, it is possible to outline a minimum set of procedures for improving the enterprise's sustainability, such as the environmental organization, employees training, reducing material losses, using Personal Protective Equipment, the adequate destination of residues, allowing the reuse of materials wasted in the process, among others. The results provide subsidies for application to small companies in Brazil and other parts of the world, once there is a low incidence of scientific work with this bias.

1. Introduction

Remanufacturing can be understood as a recovering process of a product through the disassembly and reconditioning or by exchanging some component, obtaining a product with original characteristics (Ardente et al., 2018). Remanufacturing activities, such as those provided by upholstery companies, offer upholstery refurbishment and manufacturing services based on the reuse of components, enabling aesthetic and/or ergonomic improvements at the customer's will. The most competitive price, when compared to the new product, is one of the attractions that contribute to the demand for this product/service.

Regarding environmental sustainability, remanufacturing can be more advantageous than recycling, which requires high energy consumption and the generation of liquid and gaseous effluents. Remanufacturing can save about 80% of energy and material used to manufacture new equivalent products (Han et al., 2018). However, the same authors state that none of the recovery strategies, including do not implement any strategy, is always superior to the others since it depends on several factors, including costs, government incentives, environmental factors, among others.

Remanufacturing companies have the potential to play a relevant environmental role, since this activity meets environmental objectives, for example, reducing the use of materials and energy (Ansari et al., 2018). Furthermore, there is a contribution to the reduction of waste, keeping the residual material circulating in the value chain. The search for more sustainable production patterns reinforces the need to explore alternatives that make it possible to extend the lifespan of products. This requires efforts to implement sustainability strategies in product development and the provision of services (De Los Rios; Charnley, 2016).
Although remanufacturing is an effective means of reducing waste (Ardente et al. 2018), there are barriers to align these companies with economic, social, and environmental aspects. According to Karvonen et al. (2017), some barriers are the need to recognize the environmental aspects involved in the activity, employees training, use of Personal Protective Equipment (PPE) to protect the staff, identification of the stakeholder’s needs, the establishment of an environmental policy aligned with the organization’s objectives, among others. To reduce them, there are standards of the International Organization for Standardization (ISO) that assist enterprises that seek systemic improvements, through the implementation of an Environmental Management System - EMS (ISO, 2015). There are three standards to guide organizations to achieve environmental protection together with socioeconomic needs: ISO 14005 (2010), ISO 14001 (2015), and ISO 14004 (2016).

The ISO 14005 (2010) standard focuses on the guidelines for the implementation of an EMS in phases, covering the environmental performance assessment. ISO 14001 (2015) contains requirements with guidance for the use of the EMS directing organizations that aim to achieve environmental results, and ISO 14004 (2016) refers to the general guidelines for the implementation of EMS with orientation to improve environmental management (it can be considered complementary to the previous standard).

Despite the assertion that they can be implemented in any organization, regardless of their characteristics and constitution, it was observed that it is not feasible to apply them in small businesses, such as upholstery companies, due to the absence of the following elements: Context of the organization, Leadership, Planning, Support, Operation, Performance Evaluation, and Improvement. These elements are an integral part of the standards for analyzing the feasibility of implementing the EMS. This absence is mainly due to the simple organizational structure characterized by the centralized and familiar management, familiar workforce, empiricism in-process production, absence of a business model, ignorance about the interested parties’ expectations and legislation related to the activity, absence of environmental objectives and lack of training.

In this study, micro/small companies are defined as businesses with annual gross revenue equal to or less than R$ 360,000.00 ($ 65,400.00), and the Individual Micro entrepreneur (MEI) with annual gross revenue equal to or less than R$ 81,000.00 ($ 14,700.00) (SEBRAE, 2018). Also, the informal worker who performs the activity in a similar way to those mentioned is considered. Thus, this research aims to propose a minimum EMS for micro/small companies and for the individual microentrepreneur, which can be feasible, making applicable aspects such as Environmental Improvements in upholstery companies. The absence of scientific work that addresses environmental/economic/social sustainability in upholstery companies, both in Brazil and in other parts of the world, makes the research relevant to develop the activity compatible with the three pillars of sustainability.

## 2 Methodology

The study was carried out through field research (visits) in formal and informal upholstery companies located in Teresina, Piauí, Brazil. The selection process of formalized upholstery companies, that is, the
ones who have the National Register of Legal Entities (NRLE), took place through a search on the Federal Revenue website, which makes public NRLE data available and where, also, it can be found information on the cadastral situation and the National Classification of Economic Activities (NCEA).

The NCEA makes available the code 9529-1/05, referring to the description of the service/activities performed by upholstery companies, which are: upholstery of furniture items; upholstery services; repair; upholstery renovation; upholstery repair services. Thus, 31 companies registered in this NCEA code were retrieved, however, only 21 participated in this research. The others did not accept to participate or were not found.

Many professionals offer this service in Teresina, however, it is not possible to specify this amount, because most of them work informally. Thus, seven informal companies were selected. They perform services similar to the formal companies and they are distributed in the four zones of the city. These zones are defined according to the Master Plan for Territorial Planning, which divides them into four Urban Macrozones: Development Macrozone; Moderate Occupation Macrozone; Environmental Interest Macrozone; Conditional Occupation Macrozone. For this research, the subdivisions of the Development Macrozone were used: development zones center south, north, east, southeast (SEMPLAN, 2019).

Informal companies were randomly selected, obeying the saturation criterion when the responses became repetitive, visits were concluded.

During the visits, the upholstery production process was monitored to get to know the activity, observing their business model and the entire organizational context, from the stakeholders to the waste destination. To guide the collection of information from the managers, a questionnaire was used. The next stage was to identify the environmental aspects arising from the activity and the negative environmental impacts, allowing the suggestion of a feasible standard. The most consulted EMS standard in this research was ISO 14001 (2015), as it brings the initial aspects to be considered when organizations propose to implement an EMS.

3 Results And Discussion

The detailed characteristics of the upholstery services are described in Additional file 1, as well as an overview of the upholstery companies around the world. The production process is similar in all the visited companies, starting with the furniture reception. Figure 1 describes the flowchart of the production process of upholstery furniture, explaining the environmental aspects involved in each process stage. The initial assessment of the product’s physical structure is carried out when it arrives at the company, to identify the renovation feasibility. In the disassembly stage, three aspects are considered: structure, flexibility, and appearance. In the structural assessment, it is verified if it is necessary to replace wood, foam, springs (if any), and straps.

The appearance is decided by the customer when choosing the covering material and the design characteristics that will be modified in the product. After these steps, the upholstery is covered and delivered to the customer. Employees state that there is no concern for the environment in any of the
production stages, as well as in the choice of inputs, nor the identification of environmental aspects to mitigate the negative activity's environmental impacts. It is possible to observe the raw materials used, the losses involved in the manufacturing process, and in which stages they take place to identify those that characterize environmental aspects that may cause negative impacts on the environment and human health (Figure 1).

When the components are separated, the not-used foam is destined for disposal along with household waste, as well as the shavings resulting from the wood, foam, and fabric cutting. Only one part of the wood shaving is sent for reuse in bakery ovens. Besides the discarded waste, there are also emissions of gases and particulate matter that cause impacts on human health and the environment. Thus, there is potential for implementing an EMS aiming at mitigating the various negative impacts arising from poor production process management.

### 3.1 Waste disposal

Employees claim that the materials resulting from the disassembly, due to the size and damage suffered and the shavings of fabrics and synthetic laminates, which do not have enough footage for use, are disposed to the collection of common waste carried out by the Teresina Environmental Consortium (TEC). Two companies claim to deposit the waste at Waste Receiving Points (WRP), made available by the Municipal Secretariat for Urban Development and Housing (SEMDUH), for the collection of non-household waste from small generators. The location of the final destination of these residues is defined by SEMDUH and transportation is carried out in vehicles suitable for this purpose (SEMDUH, 2020).

TEC is responsible for the collection of solid household waste, in addition to the waste resulting from the provision of services, commerce, and other activities. However, the Collection, Transport, and Final Disposal Fee for Extra-household Solid Waste is charged for residues characterized as those that due to their volume, weight, degree of dangerousness or degradability, or other specificities, require special procedures for its management and disposal, because of the negative impacts and risks to health and the environment (Teresina, 2016). Among them are domestic furniture goods, as well as those that exceed the volume of two hundred and forty liters or sixty kilograms, for twenty-four hours (Teresina, 2016). One of the companies said that it puts foam residues at the company's door every week to be taken by anyone who perceives any use. The justification for this attitude is that, usually, collectors take these products to recycling cooperatives.

Regarding wood waste, the employees of one of the companies claim that they try to make the most use of it by making boxes, shelves, organizing niches, and cutting tables. However, the material that is not used is destined for common collection. The other companies dispose of all of their waste in the common collection.

In informal companies, employees from two companies claim that new fabric shavings, when requested by artisans, are donated to the manufacture of carpets, pillows, and bags. However, there is no periodicity in the collection. Thus, when accumulated, they are destined for common collection.
The foam and fabric shavings from one of the informal upholstery companies are used to make pillows. Another four companies use the larger size shavings for making cushions and poufs. However, everyone stated that the smaller size shavings are destined for a common collection. None of the informal upholstery companies quantify the discarded material. Regarding wood waste, two upholstery companies claim that, when sought by bakeries, they sell the material to be used in ovens, but there is no frequency, so they send it to WRP.

According to data from the National Sanitation Information System (SNIS), it is estimated that in Brazil, in 2019, 65.11 million tons of solid urban waste were collected. Of this amount, approximately 48.1 million tons were disposed of in landfills and 15.9 million tons had inadequate final disposal, making a total of 24.9% of the total disposed of in soil (SNIS, 2019). The data show that the majority of dumps are in the Northeast region, with a total of 622 units, that is, 55.8% of the total registered dumps. The number of controlled landfills becomes low, only 13.8% of the total amount registered (SNIS, 2019). This data is relevant because it demonstrates the reality of the region where these companies are installed and the necessity of managing their waste.

### 3.2 Waste management

According to the employees, there is no planning for solid waste management from any of the upholstery companies. This can be explained by the managers’ lack of interest in working compatible with the mitigation of environmental impacts and, also, by the lack of partnerships with companies that can perform the selective collection of these materials, especially those that are potentially reusable.

Law No. 12,305/2010 instituted the National Solid Waste Policy (NSWP), which establishes principles, objectives, and instruments related to waste management, the generators and public power responsibilities, and applicable economic instruments (Brasil, 2010). For companies to comply with the law there must be actions aimed at the consolidation and application of its provisions and mutual interest among all spheres of society. Thus, strategies that seek cleaner production, a more circular production chain, planning the product’s life cycle, understanding of social responsibility, must be increasingly aligned with any manufacturing process.

In Chapter II, Art. 3, item IV of the NSWP, the product life cycle is defined as a series of steps that involve product development, from obtaining inputs, through the production process, consumption, and disposition (BRASIL, 2010). Thus, in the planning phase of a product, all steps from pre to post-consumption must be known identifying the environmental aspects to mitigate those with a potential negative impact on the environment.

The law objectives range from the protection of public health and environmental quality to the encouragement of environmental labeling and sustainable consumption. Also, the law suggests waste management starting with the non-generation, reduction, reuse, recycling, treatment, and environmentally appropriate disposal (Brasil, 2010). Therefore, the law suggests rethinking the production, by recommending not to generate waste, seeking to minimize as much as possible any waste, until the
material is not amenable to use, and it needs adequate disposal. In upholstery services, although some materials are reused during the process, there are still no practices aiming at reducing waste. There are sporadic actions, in some enterprises, to make some waste available for collection, by artisans, however, there is no periodicity and monitoring of the occurrence of this practice.

The use of residual upholstery material for the manufacture of other consumer goods (such as artisanal goods), refers to the concept of upcycling which, according to Bridgens et al. (2018), is the use of discarded objects or materials, to create a new product with quality and value superior to the original. The activities involving the reuse of materials can be influenced given the social, economic, and political context in which they are inserted and pay attention to the care that must be taken regarding discriminatory positions that the reuse of waste by artisans generates products of low quality. The reuse can be carried out with skill and aesthetic quality.

Another issue is related to the reuse of wood waste. Some upholstery companies provide these materials for use in bakery ovens. However, Top (2014) explains that despite reusing waste, there is environmental pollution caused by the burning of fossil fuels. This pollution is aggravated if the burning is performed in wood stoves, ovens, and wood boilers because it is necessary the complete combustion of wood residues and this is only achieved when the firing takes place on appropriate furnaces so that pollutants such as carbon monoxide, manganese, and organic compounds do not continue to be released. The ideal scenery is the waste returning to the supplier company, so it can give an environmentally appropriate destination. This is possible through integration between the supplier and the company that uses the input.

According to Bridgens et al. (2018), another way for a more assertive destination would be with products designed intentionally to meet the needs of a second life cycle, with functional aspects different from the original, differentiating them in post-consumption. When the product is planned to have a second life, its design provides reuse, different from those that do not have this intrinsic value. In this case, ad-hoc recycling is performed in a product that, initially, was not designed for this purpose, resulting in less reusable components.

4. Environmental Aspects Involved In Upholstery Services

ISO 14004 (2016) defines environmental aspects as the interaction of elements of an organization's activities, products, or services with the environment. The standard also explains that the term environment refers to the surrounding area in which the organization operates, including air, water, soil, natural resources, flora, fauna, human beings, and their interrelations. To determine the environmental aspects involved in the activity, some points must be observed, such as emissions to air; land launches; use of raw materials and natural resources; generation of tailings and/or by-products.

4.1. Environmental aspects: emissions to air

Emissions to air are neglected by the surveyed companies. Only in one of them do employees use a mask. In the others, there is no protection to prevent the inhalation of dust particles or gases. Employees
were asked if they felt any physical reaction during exposure to gases and dust. They replied that sometimes they feel nausea, headaches, dizziness, nasal congestion, and rhinitis, but that the symptoms do not always appear together and that, over time, the frequency of occurrences decreases.

The rhinitis’ manifestation is due to exposure to dust and because the adhesive is a respiratory sensitizer, defined by ABNT NBR 14725-1 (2009) as a substance that induces upper airways’ hypersensitivity. The classification criteria for substances that are respiratory sensitizers are the evidence characterized as hypersensitivity reactions that include asthma, rhinitis, and conjunctivitis. The adhesive’s composition is toxic for humans and is classified as a dangerous product. A synthetic adhesive manufacturer makes this information available to consumers in FISPQ No. 26, in which contact glue is classified following Ordinance 204 - Classification and definition of dangerous products class (Brasil, 1997).

The contact glue FISPQ indicates that the components that contribute to the product’s danger are organic solvents, which contain toluene and a mixture of hydrocarbons. The record classifies the product as dangerous because it is flammable and toxic, also presenting damage to humans, environmental, physical, and chemical hazards, and toxic effects (FISPQ, 2012). The acute toxic effects to human health, due to excessive exposure to the adhesive are respiratory tract, skin, and eyes irritation; corneal irritation or burns, headache; nausea; dizziness; somnolence; dermatitis on the skin (BRASIL, 1997). The symptoms reported by employees were rhinitis, headaches, nausea, and dizziness.

Bortey-Sam et al. (2017) observed in their study that human beings exposed to compounds that contain hydrocarbons, such as those of synthetic adhesive, present rhinitis, nasal congestion, persistent cough, and headaches. Rengarajan et al. (2015) further explain that exposure to this chemical component occurs in different ways, one of them is inhalation and dermal contact in work environments, which is considered a potential occupational carcinogen.

4.2 Environmental aspects: launches on land, use of raw materials and natural resources, and generation of tailings and/or by-products

Other environmental aspects identified in the upholstery companies are launches on land and the generation of tailings and/or by-products. Among the solid waste, there are fabrics, non-woven fabrics, synthetic laminates, and wood. When they are discarded, added to the material, there is the energy spent for the processing of this raw material, increasing negative environmental aspects, initiated with the use of chemicals present in some textiles and synthetic laminates production process and that will end up launched into the environment.

According to data from the Brazilian Association of the Textile and Clothing Industry - ABIT (2020), this is an important economic sector representing 16.7% of jobs and 5.7% of the Manufacturing Industry turnover, with a turnover of R $ 185.7 billion in 2019. Thus, for Oliveira Neto et al. (2019) strategies such as Cleaner Production that seek a change in the waste generation scenario, aiming at approximating sustainability in the textile chain, must be implemented. Rovira and Domingo (2018) affirm that in the textiles finishing stages (bleaching, printing, dyeing, impregnation, coating, plasticization) different
chemical substances are used resulting in the generation of dyes, metals, pentachlorophenol, whiteners such as chlorine, biocides, halogen transporters, free formaldehyde, and softeners, which are harmful to the environment and human health.

The environmental impacts caused by textiles are part of the entire production chain. It is also related to factors such as thread and fabric thickness and the types and mix of fibers used in textile manufacture, which influence the decomposition or recycling process. In addition, natural fibers (like cotton) represent a global volume of approximately 40% of the total production of textiles and demand considerable use of water resources, besides the application of pesticides and fertilizers, while synthetic fibers are produced from non-renewable resources and toxic products, which also points to their polluting potential (Dahlbo et al., 2016; Hole, G.; Hole, A., 2018).

The management of textile waste (especially post-consumption) should be a priority and reuse, recycling, and incineration with energy recovery, are strategies that can mitigate them, in contrast to designate it to landfills (Yasin et al., 2017; Norup et al., 2018). Landfills are still the most widely used disposal route, considered economically viable, even knowing the gases emissions in addition to the use of large areas for their allocation (Yasin; Sun, 2019). Thus, rethinking the product’s life cycle, ensuring that the destination of pre-and post-consumption waste is carried out appropriately, contributes to reducing environmental damage.

5. Analysis Of Environmental Management System Standards And Applicability In Upholstery Companies

The EMS standards were designed to serve the most different organizations, regardless of the type of activity, the enterprise’s nature, and size, and can be used in small, medium, and large companies. The approach considered by the ISO 14001 (2015) standard is based on the concept of the Plan-Do-Check-Act (PDCA) cycle, always seeking to observe the objectives, the implementation of the planned processes, the monitoring of these processes and actions for continuous improvement.

However, to start the evaluation process of the organization that chooses to implement the EMS, it is necessary to analyze seven PDCA Cycle elements: Plan (1- Context of the organization; 2- Leadership; 3- Planning; 4- Support); Do (5- Operation); Check (6- Performance evaluation) and Act (7- Improvements). Each element has specifications that must be considered (ISO, 2015; Jonhstone, 2020). A simplified example of PDCA cycle application for environmental improvement regarding the management of upholstery waste is described in Figure 2.

Planning for better waste management can trigger practical and simple actions, such as proper separation for selective collection, resulting in environmental benefits and favoring better economic performance with the reuse of a material that would be discarded. Thus, applying the PDCA cycle in upholstery companies can help, both in sales and profit goals, as well as in environmental and social issues.
Some characteristics pointed out in the standard are different between small, medium, and large companies, mainly due to the organizational structure of larger enterprises that allows for better management, with the division of labor, application of strategies and resources by sector, internal systems, and conduct regarding environmental issues. So, the application and analysis of some tools become more complex (Jonhstone, 2020).

Therefore, a gap was identified between what the standard points out as requirements for analysis in upholstery companies. For a better understanding, Table 1 presents the description of the seven elements. These elements are not known by the upholstery managers. This is mainly due to the constitution of the activity, without any organizational structure that promotes improvements, not only economic, but also social and environmental in the short, medium, or long term. Thus, there is potential for the development of a standard that is feasible and applicable to the reality of small companies such as upholstery companies.

Table 1: Description of the elements of the ISO 14001:2015 standard for the EMS implementation
| Requirement with guidance for use | Description of the elements |
|----------------------------------|-----------------------------|
| 1 Context of the organization    | - Understanding the organization and its context  
- Understanding the needs and expectations of interested parties  
- Determining the scope of the environmental management system  
- Environmental management system |
| 2 Leadership                     | - Leadership and commitment  
- Environmental policy  
- Organizational roles, responsibilities, and authorities |
| 3 Planning                       | - Actions to address risks and opportunities  
- Environmental aspects  
- Compliance obligation  
- Action planning  
- Environmental objectives and planning to achieve them  
- Planning actions to achieve environmental objectives |
| 4 Support                         | - Resources  
- Competence  
- Awareness  
- Communication  
- Documented Information |
| 5 Operation                       | - Operational planning and control  
- Emergency preparedness and response |
| 6 Performance evaluation         | - Monitoring, measurement, analysis, and evaluation  
- Internal audit  
- Management review |
| 7 Improvement                    | - Nonconformity and corrective action  
- Continual improvement |

Source: ISO (2015)
6. Proposed Environmental Management System For Upholstery Companies

Through the scenario presented on the upholstery business, the information on the identified problems and environmental issues were gathered in Tables 2 and 3. Table 2 describes an overview of the problems identified in the upholstery companies and the practices that can be adopted aiming at improvements.

In the upholstery companies, no layout facilitates operations and, for the most part, there is no organization with materials in a defined location. The suggestion is the adoption of organizational principles that facilitate daily work, as proposed in the 5S methodology, of Japanese origin, in which each “S” corresponds to the development of an aspect: 1 - SEIRI (Sense of Use); 2 - SEITON (Sense of Organization); 3 - SEISO (Sense of Cleanliness); 4 - SEIKETSU (Sense of Standardization and Health); 5 - SHITSUKE (Sense of Discipline and Self-discipline). This type of methodology contributes to all areas of the business, as it involves processes and behaviors (SEBRAE, 2017).

**Table 2:** Overview of the problems identified in the upholstery companies
| Analyzed criteria | Identified barrier | Verified problems | New practices |
|-------------------|-------------------|------------------|--------------|
| 1- Infrastructure: Organization | Lack of organization in the work environment. | Improper packaging of raw materials, preventing their future use. | - Use of the 5S Methodology.  
- Material cost reduction. |
| 2- Infrastructure: Lighting | Little artificial lighting. The predominant use of insufficient natural light. | Less efficient execution in stages that require greater care to avoid accidents. | - Artificial lights with focus directed to the object ensuring safer and higher quality work.  
- Compliance with the Standard |
| 3- Infrastructure: Ventilation | Poor air circulation. | Many upholsteries furniture piled up and close to the ceiling, hindering air circulation and strong musty odor. | - Improvement of workers’ health.  
- Reduce storage time. |
| 4- Infrastructure: products packaging | Inappropriate accommodation of materials. | The materials are in direct contact with the floor and dirt such as dust and residues. | - Material cost reduction.  
- Loss reduction.  
- Provide storage infrastructure. |
| 5- Training | Absence of information on production practices. | Waste of some inputs in the production process. | - Improvement in the production process, reducing the risk of losses.  
- Employee training. |
| 6- Raw material | Material loss. | Absence of knowledge about modeling, causing losses in the cut. | - Use of modeling.  
- Improvement of the production process, reducing the risk of losses; |
| 7-Personal Protective Equipment | Absence of PPE. | Respiratory problems resulting from contact with dust, gases, glue. | - Improvement of workers’ health.  
- Safety in the work environment.  
  
- Sharp objects. |

Source: Authors

Some rules establish parameters for the necessary adaptations, aiming to ensure the worker’s health and safety. ISO 8995-1 (2002) - Workplace lighting Part: 1, specifies the lighting requirements for indoor workplaces and the requirements for people to perform visual tasks efficiently, comfortably, and safely.
during the work period. The luminance distribution must preserve the efficiency of the eye functions, maintaining comfort, performance, and visual safety. In this way, the balance between diffused and directional light must occur considering the verification of the lighting quality in indoor environments. Adequate values for maintained illuminance should be 300 lux (illuminance unit) (ISO 8995-1, 2002).

The upholstery furniture is piled up, causing the obstruction of natural air, preventing good air circulation, increasing the possibility of fungi proliferation, and stopping gases and dust in the environment, causing problems related to the health and well-being of employees. Complementary Law No. 4,729, of June 10, 2015, Teresina's Construction and Building Code (Teresina, 2015), determines that places of prolonged stay that do not have openings for lighting, insolation, and ventilation, must adopt mechanical ventilation. The suggestion for the companies would be to unblock air passages and use fans when the employees are handling synthetic adhesives.

The accommodation of materials does not follow any procedure that keeps them out of contact with dirt. In this way, the adoption of storage structures such as drawer boxes and shelves can be the solution for accommodating materials of different sizes. According to Regulatory Norm - NR 6 (MTE, 2015), the use of PPE by workers aims to protect them from risks in the work environment. The company is obliged to provide PPE free of charge to employees who, in return, are responsible for using them correctly. The use of PPE can avoid the problems described in Table 2, criteria 7.

Another issue to be observed among employees is training. The training of employees has the function of keeping them informed and qualified to perform their activities in a better way. The loss of raw material could be reduced, for example, with training in modeling, which would allow greater precision in the material cutting process, reducing inputs waste. The partnership with SEBRAE can be a way to train employees, since the entity offers several courses, in different locations, in-person and online. In the upholstery companies, also, the environmental aspects involved in the activity were verified, as shown in Table 3.

Regarding environmental aspects, some initiatives can reduce their harmful effects. The main problem caused by emissions to air is the employee who, when working without PPE, inhales dust and toxic gases exhaled by synthetic adhesives. The toxicity generated by aromatic hydrocarbons (the basis of these adhesives) interferes with cell membranes. In addition, they promote carcinogenic and mutagenic effects. Also, they are potent immunosuppressants, compromising the immune system and host resistance (Abdel-Shafy; Mansour, 2016). Thus, the use of PPE is essential. About launches on land and waste or by-products generation, a strategy to avoid them would be to establish a partnership with production centers, artisans, and universities, for the use of these inputs in other production processes.

Table 3: Observed environmental aspects and identified problems in upholstery companies
| Analyzed criteria | Identified barrier                                                                 | Verified problems                                                                 | New practices                                                                 |
|-------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| **Emissions to air** | Absence of minimum care to avoid inhalation of gases exhaled by the glue and dust | Collaborators with clinical issues like nausea, headaches, dizziness, nasal congestion, and rhinitis. | - Use of PPE to improve the protection against accident risks and improvement in workers' health. |
| **Land launches**   | Absence of solid waste management.                                                 | Destination of materials with potential for reuse at the landfill.                 | - Separation of materials with potential use to revenue generation through sale or use in other products. |
|                    |                                                                                    |                                                                                   | - Environmental improvements.                                                 |
| **Generation of waste and/or by-products** | Absence of planning and modeling contributing to material losses.                  | Fabric, synthetic laminates, and wood shavings waste.                              | - Partnership with Production Centers and artisans to reuse the material in other products. |
|                    |                                                                                    |                                                                                   | - Contribution to the local economy.                                           |
|                    |                                                                                    |                                                                                   | - Environmental improvements.                                                 |
| **Use of space**    | Use of the sidewalk and public road for the disassembly and assembly of upholstery furniture. | The difficulty for pedestrians to walk on the sidewalk and cars on public roads, and waste not collected. | - Social and environmental responsibility, through better use of the company internal space, avoiding external occupation. |
|                    |                                                                                    |                                                                                   | - Correct waste disposal.                                                     |

Source: Authors

Regarding the use of space, such as sidewalks, enterprises must comply with Law No. 4,522 (Teresina, 2014), which establishes standards and criteria for their construction, reconstruction, conservation, and use of sidewalks in Teresina. Chapter VII, which deals with sidewalks conservation/cleaning, states that depositing, throwing waste of any kind is harmful to the conservation and cleaning of sidewalks. Another law to be considered is Complementary Law No. 3610 (Teresina, 2007), which also deals with this issue.

It is important to mention that municipal government participation is fundamental in reaching the proposed goals. The city hall may assist with partnerships for the collection of waste and sent for recycling, increasing the inspection regarding the use of sidewalks for the disposal of materials. The government can also intermediate the partnership with waste collector’s cooperative to provide the appropriate destination for potentially reusable waste. Thus, with the public authorities’ collaboration, companies can envision the potential for implementing a feasible EMS in upholstery companies.

7. Conclusion
The results show a scenario of great potential for improvement and adaptation to an EMS in upholstery companies. The production process monitoring and understanding the services provided to the population made it possible to outline initiatives that take these companies to another level of competitiveness in the market, in a more orderly and planned manner, aiming at the economic benefits and understanding about the activity socio-environmental responsibility.

The suggested practices, also, aim at greater public power notoriety regarding the activity, since, in general, this sector is on the margins of society. There are no actions to improve management, especially of waste and use of public space (sidewalks). The municipal government participation can help the goals of EMS, considering that the sector is representative of the population attending, mainly, those that look for the refurbishment of the upholstery furniture due to the lower cost.

The proposed EMS meets the minimum required to transform the sector and provide better conditions for upholstery companies, aiming at improvements to achieve the three pillars of sustainability (social, economic, and environmental), which can be developed by the small entrepreneur with the government and support institutions partnership. The system can be applied in other parts of Brazil and the world. The benefits would directly and positively impact the individual microentrepreneur, the informal worker, their neighbors, employees, customers, and all society.

**Declarations**

**Availability of data and material**

The dataset(s) supporting the conclusions of this article is(are) included within the article (and its additional file(s))

**Conflicts of interest/Competing interests**

The authors have no conflict or competing interests

**Funding source**

Funding: This work was supported by CNPq - Research grants (Process n° 401320/2016-2 and Process n° 422087/2018-1) and Research productivity scholarship (Process n° 304974/2018-8) and FAPEPI (Notice FAPEPI/MCT/CNPq Nº 007/2018 - Infrastructure Program for Young Researchers/First Projects Program).

**Authors' contributions**

S. N. R. L.: wrote the paper, collected data, performed the analysis

N. B. R. M.: contributed data and analysis tools, conceived, and designed the analysis

J. M. M. N.: contributed data and analysis tools, conceived, and designed the analysis
E. A. da S.: contributed data and analysis tools, conceived, and designed the analysis

Acknowledgements

Not applicable

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Figures

Figure 1
Flowchart of the upholstery production process and identified environmental aspects
Figure 2

Simplified example of using the PDCA cycle tool in upholstery companies for waste management

**Supplementary Files**

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