TEXTILE WASTE REVALUATION SYSTEM: FROM DESIGN TO IMPLEMENTATION

BANCO DE RESÍDUOS TÊXTEIS: PLANEJAMENTO E RESULTADOS INICIAIS DE IMPLEMENTAÇÃO

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ABSTRACT

This article presents the planning process and the current stage of implementation of a post-consumer and industrial textile waste reuse system in a waste picker cooperative in the city of Londrina, called Textile Waste Bank (BRT). This system represents a new business opportunity for the cooperative, seeking to create new jobs and income for waste pickers whose economic and financial situation has been aggravated by the Covid19 pandemic that affects Brazil and the world. The theoretical-methodological bases of this study include Systems Design, Design for Sustainability, Circular and Distributed Economy, among others, and the research methodology is based on Action Research in Design, complemented with other auxiliary methods. Initial results include the definition of the BRT operating model, production flow, product development and acquisition of equipment that will be installed in the cooperative for processing textile waste, as well as articulation with a partner company for the initial supply of materials for testing of production.

KEYWORDS: Textile Waste; Recycling; Collectors Cooperatives; Systems Design; Circular Economy.

RESUMO

Este artigo descreve e discute o processo de planejamento e o estágio atual da implementação de um sistema de revalorização de resíduos têxteis pós-consumo e industriais em uma cooperativa de catadores da cidade de Londrina, denominado Banco de Resíduos Têxteis (BRT). Este sistema representa uma nova oportunidade de negócio para a cooperativa, buscando criar postos de trabalho e renda para os catadores cuja situação econômico-financeira tem sido agravada pela pandemia de Covid19 que afeta o Brasil e o mundo. As bases teórico-metodológicas deste estudo incluem o Design de Sistemas, Design para a Sustentabilidade, Economia Circular e Distribuída, entre outras, e a metodologia de pesquisa baseia-se na Pesquisa-Ação em Design, complementada com outros métodos auxiliares. Os resultados iniciais incluem a definição do modelo de operação do BRT, do fluxo de produção, desenvolvimento de produtos e aquisição de equipamentos que serão instalados na cooperativa para processamento dos resíduos têxteis, além da articulação com uma empresa parceira para fornecimento inicial de materiais para testes de produção.

PALAVRAS CHAVE: *Reciclagem; Cooperativas de Catadores; Design de Sistemas; Economia Circular.*

1. INTRODUCTION

1.1. Textile waste problem

From Hoornweg and Bhada-Tata (2012) research about the textile disposal in Latin America, it is esteemed that the annual average of textile waste produced per habitant in Latin American countries is between 7 and 9kg; that said, it is possible to indicate that the city of Londrina, in the north of Paraná and with almost 560 thousand citizens, produces between 3,900 and 5,000 tons of textile waste annually, material that comes from the Apparel Sector, specifically post use waste, in other words, disposed by the consumers. Although urban solid waste (MSW) is regulated in Brazil through Law No. 12,305 (BRASIL, 2010), which instituted, in 2010, the National Solid Waste Policy, this regulation does not cover textile waste, both industrial and post-use, in this way, all textile material that arrives at selective collection cooperatives is sent to sanitary landfills, generating significant environmental problems such as clogging of leachate flow ducts and an increase in the volume of materials discarded there. There are also economic losses, due to discarding a material that could be reused, expenses to the public power, with the cost of transporting the textiles to the sanitary landfills, and unpaid work of the cooperative members, as they need to separate and forward a material that currently does not generate income for cooperatives.

According to the survey carried out in a selective collection cooperative in the city by Ramos, Sampaio and Martins (2019), only this one received about a ton of this type of material monthly, even without being able to carry out this collection, as it was not paid to do so.

This material was considered waste and was destined almost entirely to voluntary delivery points and then to the city's sanitary landfill. Another problem of not having specific places for the disposal of textile waste is that, in addition to going to sanitary landfills, they were also discarded in inappropriate places, such as bottom of valleys. In view of this context, it is possible to characterize the issue of textile waste as a significant environmental problem, but also an economic opportunity for cooperatives, which can, through the revaluation and reuse of this type of material, obtain new financial gains. In this way, the research group to which this subproject belongs proposed, developed and is implementing a Textile Waste Bank (TWB) within a selective collection cooperative in the city as a way to solve the problem of textile waste, specifically post-use waste. The TWB is a system created to correctly collect, sort, process and dispose of textile waste within recycling cooperatives. The system operates through pre-established stages and material flows and is in the initial phase of implementation, so this research seeks to explore strategic issues, such as detailing, management and training for implementation.

1.2. Theoretical-methodological bases

For the understanding of the problem and the elaboration of the systemic solution proposal presented in this article, the present study was supported in some main theoretical-methodological propositions. In order to approach the problem in a broader and more systemic way, two solid approaches to the project were sought in Systems Thinking and Systems Design. The first is an interdisciplinary area of studies that seeks to understand phenomena of a complex nature, including interactions between human beings, their activities and technology (sociotechnical system) and with the environment, based on a systems perspective. A system is understood as "an integrated whole whose essential properties emerge from the relationships between the parts that compose it" (ISON, 2010), and also as "a whole, an entity that an observer can cognitively dissociate from a context" (ISON, 2010), and "exhibits a certain form of organization that determines its individual character" (VANDENBROECK, 2015). The second, is an approach to design for sustainability that aims to create sustainable systems based on meeting human needs (VEZZOLI, 2010) in the context of complex sustainability problems (wicked problems). Solid waste represents such a wicked problem.

In order to include environmental, social and economic aspects from the beginning of the project, the Design for Sustainability was adopted from the start, which consists of an expanded approach to Design that seeks to contemplate in a balanced way the main dimensions of sustainability (environmental, social and economic), whether in the redesign of existing products, in the design of new products and services to replace the current ones, in the design of intrinsically sustainable product-service systems, and even in the development of new scenarios for sustainable lifestyles (MANZINI; VEZZOLI, 2002; SAMPAIO *et al*, 2017). This adoption took place mainly at the level of heuristics and social, environmental and economic guidelines. With regard specifically to the extension of the life of materials, the concept of Upcycling was adopted, which, according to Braungart and Mcdonough (2013), seeks to return a product or material to the production cycle

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while preserving its technical qualities. It consists of giving a new and better purpose to a material or product, that would be discarded without degrading its quality and composition, maintaining the same or better quality than the original. Upcycling differs from recycling as it requires chemical processes to replace new raw materials, while upcycling maintains its original structure.

In terms of economic approach, the concept of Circular Economy was adopted, a form of economy "restorative and regenerative in principle. Its aim is to keep products, components and materials at their highest level of utility and value at all times, distinguishing between technical and biological material cycles. This approach ultimately seeks to decouple economic development from the consumption of finite resources and eliminate negative externalities from the economy" (ELLEN MCARTHUR FOUNDATION, 2019). The Circular Economy was complemented with the Distributed Economies approach, which is based on the organization of business in networks, with a strong decentralized character, and in which the creation (design) and distributed production and the constant flow of information and knowledge through technologies of information and communication (ICTs) are key aspects of the system (JOHANSSON; KISCH; MIRATA, 2005). Considering that the TWB is also a business to be implemented in the collectors' cooperative, a way to develop new businesses based on value was sought in the Business Model Design, considering the different parts that make up a business structure, and for that it uses creation methods and tools with a strong visual and collaborative character, being the Business Model Canvas one of the best known (OSTERWALDER; PIGNEUR, 2011). The development of this business model, as well as related products and services, was also supported by the innovation approach of Design Thinking (DT), a specific way of thinking about solving broad and complex problems, centered on empathy, creativity and experimentation, as well as a non-linear, iterative, essentially exploratory and systemic method of solving these problems. DT offers a new way to do something, to adapt it to an existing or new business system, and to generate value for a new product, service or process. It has a humanistic, intuitive nature, which takes into account both the emotional and functional aspects of the user (BROWN, 2010). As a complementary approach to the DT, a specific innovation methodology for creating value from waste was also used, the FLOWS Methodology, which is a methodological model based on Design for innovation in solid waste, developed by Sampaio (2017). The FLOWS Model brings a set of methods and tools that are supported from the identification of the problem to the development of new materials, products, services and business models that allow the revaluation of this waste.

All these approaches served as a reference for the conceptualization and development stage of the BRT, whose proposition, prototyping and beginning of implementation are described below.

2. METHODOLOGY

The main research methodology of this study was based on Action Design Research, complemented with auxiliary methods such as Unsystematic Bibliographic Review, development and analysis of artifacts, field research, photographic and videographic records. Action Research in Design, as well as the action research from which it derives (SANTOS *et al*, 2018), is based on the intervention in the reality of a certain group (in this case the cooperative) by researchers, and on the construction, testing and implementation of artifacts (materials, products, services, systems) that help to improve the reality of that group. This construction is made in part by the researchers, but also built in a participatory way with the target social group of the study. It is a methodology that seeks to promote changes in reality, whether technological (a new material, product or process), economic (in this case, the generation of work and income), social (quality of life, working conditions, respect and personal valorization) or environmental (reduction in environmental impacts with a better destination of textile waste), among other aspects.

3. RESULTS AND ANALYSIS

3.1. System Design

The TWB system model has been developed and improved by the research group Design, Sustainability and Innovation at UEL (DeSIn) since 2017, having several changes from the various discussions with actors involved in the design of this system, including researchers from Design, Administration and Engineering, two partner companies (a clothing manufacturer and a fabric recycler) and a group of cooperative members from Cooper Região. From the lessons learned in this process, it was possible to arrive at a system model that is more adequate to the needs of the various users, including the city residents who will allocate the material for recycling, the cooperative that will operate the system and the partner companies that can both collaborating and being TWB´s business partners.

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The main model with reception, through the creation of a system map (figure 1), organized in two parts, sorting and processing of textile objects and processing of textiles (figure 1), and another focus and sale of textile products, set made from processed textile material (Atelier), independent of the company and of an isolated social enterprise in the form of a social enterprise. The first, will have three main sources of revenue: the sale of shredded material and pieces of fabric to companies, and clothing in good condition to final consumers, through its own thrift store; the second will have as a source of revenue the sale of products with high added value to final consumers.

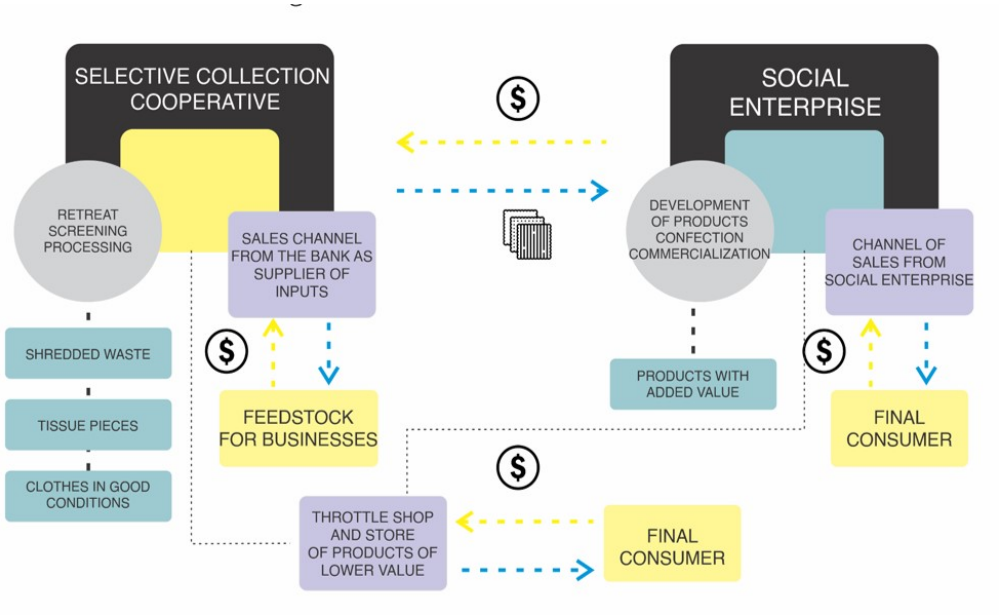

Figure 1. Main model of textile waste bank. Source: prepared by the authors (2022).

This model seeks to solve some of the main problems identified in the research carried out in previous years, in particular two of them: 1) the need for decentralization of the model, to solve the problem of system management by the selective collection cooperative, which does not have in the area of creation, manufacture and commercialization of products with high added value; 2) the financial issue, since the cooperative would have to bear the initial investments of two work fronts. The proposal to create a social enterprise to use sorted and processed waste in the manufacture of products separately from the TWB meets the need to make the most of the cooperative's main expertise, which is the qualified sorting of recyclable materials, avoiding dispersion of efforts and resources. When the Creative Atelier is implemented through a social enterprise, the system is decentralized, but the work fronts continue to be linked, since the Creative Atelier depends directly on the production of TWB in the cooperative. In addition, a company focused on the production and sale of higher value-added products, may have a positive impact on sales of material processed by the TWB, by creating a constant flow channel for processed materials.

The formation of the business plan and the team responsible for the social enterprise Creative Atelier, is still being defined while the TWB part is already beginning to be implemented, with the purchase of equipment and preparation of the physical space.

The implementation of TWB depends directly on financial resources, which were recently obtained thanks to a public notice in which the TWB project was approved. Another complicating factor refers to the need for an unequivocal understanding of the roles that each of the actors in the system plays. There was an understanding on the part of the cooperative that the research team would be responsible for making the implementation financially viable, and that while there were no resources to remunerate the cooperative members to operate the TWB, it would not be possible to start the operation. It was necessary to prepare a Term of Commitment clarifying the responsibilities of all parties to make this aspect clear: the cooperative would also have to assume some costs and risks, as it was not possible for the research team to be fully responsible for the financial viability of the system. This document was also necessary to

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clarify the ownership of the equipment being acquired with public funding resources, as the funding notice provided that the equipment should be owned by the proponent, in this case the State University of Londrina (UEL), and not with the cooperative (its director understood that the equipment would be owned by the cooperative). The solution in this case was to establish a lending regime for the equipment for an initial period of two years, which can be renewed later or returned to the university for new projects. An important learning in this case refers to the difficulty of dealing with legal and bureaucratic aspects, especially in defining the responsibilities and rights of the actors in the system and in the use of funding resources with the university, especially in the latter due to the slowness in the purchasing process that often delays (often by months) the implementation of the system. This is a bottleneck to be solved by the university as it negatively affects the work of researchers, both in the delay of planning and in the motivation to seek funding in future projects.

3.2. System prototyping

The prototyping of the system was carried out in early 2020 with the Cooper Região cooperative and was made possible thanks to an award received by the DeSIn research group in the Tomie Ohtake-Leroy Merlin Prize contest, in the amount of BRL 5,000. This resource was used to remunerate the work of two cooperative members for four weeks, in order to enable them to correctly separate the textile waste received at the cooperative, and also to purchase a washing machine to sanitize the fabrics received, in addition to some consumables. Thus, the following system steps were tested:

- Receipt, separation and cleaning of materials (figure 2);
- Disassembly of garments when necessary (figure 3)
- Fabric fragmentation, with the support of a textile recycling company in the city (figure 4);

Figure 2: Cooperatives separating post-consumer garments. Photo: Ingrid Gonçalves (2020).

Figure 3: Cooperated disassembling a post-consumer garment. Photo: Ingrid Gonçalves (2020)

Figure 4: Textile waste fragmentation by partner company. Photo: Ingrid Gonçalves (2020)

• Pressing tests of the fragmented material to create plates that could be used as raw material in various products (figure 5).

Figure 5: Plate of fragmented tissue obtained by pressing. Photo: Ingrid Gonçalves (2020)

From this prototyping, it was possible to identify two bottlenecks in the system that should be corrected, as they made the system inefficient: the manual disassembly of garments to remove the trim (buttons, zipper, metal inserts) and cleaning (washing and drying). The first could be optimized with the acquisition of better equipment (scissors, cutting machines), but the second represented a barrier that needed to be overcome, since washing and drying demanded a lot of work and use of the washing and drying machine, which moreover it had a limited ability to operate. This led the research team to decide to remove the cleaning stage, proposing that the textile materials should be received already cleaned.

This decision led the team to invest more efforts in creating a solution that would lead city residents to deliver clean after-use textiles, mostly clothes, which was then tested by working together with other researchers from the Ninter research group, integrating the collection of post-consumer textiles in an integrated system (Separar é do Bem Project) that was tested in a vertical condominium with 104 apartments for 30 days. This experiment is currently being finalized, and the results will be announced shortly. In addition to prototyping the system, carried out just before the pandemic at the beginning of 2020, products were also prototyped that could be made from the reuse of textile waste, which will be presented below.

3.3. Products prototyping

With the outbreak of the pandemic, no further activities could be carried out within the cooperative, and it was necessary to look for another alternative so that the research project could continue in progress. After a period of adaptation to the new reality, the research group established a partnership with a clothing manufacturing company that was a partner in the project, and from the beginning of 2021, part of the scholarship holders was able to develop their activities within the company, which made spaces available, equipment and waste materials from production for product prototyping. The project team then developed three possibilities of products to be reproduced and commercialized by the socio-environmental business (Creative Atelier) already mentioned.

This stage was restricted to the use of post-industrial waste from the company, however the proposal idealized for Creative Atelier should also cover post-consumer textiles generated by the population, in addition to other clothing companies in the region. The GMTex jeans industry located in Londrina, made the denim available (figure 6) from the company's leftovers, cut into a rectangular shape that comprises the dimensions of 10 centimeters (cm) in width and variable length (16cm, 26cm, 32cm etc.). In this way, this residue was applied to the outside of the products by joining the rectangles to build the ideal base size for each product, ensuring harmony in the color fit. In addition, the company made available the use of sewing machines and accessories needed from the factory to carry out the prototyping stage.

The company Estopas Coelho from the city of Ibiporã, near Londrina, provided 25 kilos of shredded denim (Figure 7) to be used as filler in the products, as can be seen in Figure 3. In addition, the University Hospital of Londrina (HU) provided the tri-fabric SMS (Spunbond-Meltblown-Spunbond), a material that is characterized as a non-woven fabric (TNT) usually used as packaging for surgical boxes, which is discarded by the hospital's surgical center. This material, which has a microbial barrier, impermeability, resistance, and malleability, was used as a lining in the prototypes.

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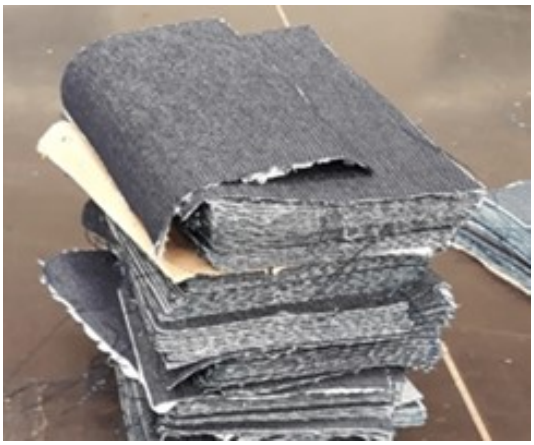

Figure 6: Denim fabric from the production leftovers of the company GMTex. Source: Prepared by the authors (2021)

Figure 7: Denim fabric provided by the company Estopas Coelho. Source: Prepared by the authors (2021)

Based on the arrangement of materials supplied by the partner companies, three products were chosen for prototyping, considering both the usefulness and effective use of shredded fabrics and the level of difficulty in making them, since the cooperative members who will carry out this process do not have advanced knowledge of sewing. The research team designed and prototyped three products that could use shredded material as a filling: a pillow (figure 8), a pet bed (figure 9) and a pouf (figure 10). The prototyped products will still have to undergo tests to improve aspects necessary for their production and commercialization, such as weight, dimensions, possibilities of patterns through the fitting of textile retraces, use of double lining, among others. In addition to these products, communication elements are being developed by the project team aimed at the customer segment (packaging, label, tags), and the next activities include the creation of communication pieces for the partnerships and cooperative members of the project.

Figure 8: Pillow prototype. Source: Prepared by the authors (2021)

Figure 9: Dog bed prototype. Source: Prepared by the authors (2021)

Figure 10: Pouf prototype. Source: Prepared by the authors (2021)

In addition, a market study will be carried out in order to prospect opportunities for commercialization of these products and define the sales strategy. Another important aspect in the BRT system refers to the need to capacity the people who will operate the TWB, which will be discussed below.

3.4. Training

As it is a new system and business model in the cooperative, the members need to be instructed according to the activities to be carried out. Considering the division of the system into two distinct parts (TWB and Creative Atelier), it was also necessary to plan different training courses for each work front. For the steps carried out by the selective collection cooperative (sorting, processing and forwarding) the main objective of the training is to develop the competence of identifying fibers and separating the qualities of materials that will be processed and identification of textile waste that can be commercialized without going through the fragmentation stage, such as pieces of fabric, parts in good condition and trims in good condition from the disassembly stage This competence is very important to be developed, since the Bank's income in the cooperative will directly depend on the materials that will be offered by it. Therefore, the identification of some characteristics of textile waste needs to be instructed to the cooperative members, namely: Classifications of textile fibers; Quality of materials; State of conservation and quality of textile remnants; State of conservation of the pieces; and Use and forwarding of each material.

3.4.1. Training

To define which waste classifications will be instructed, it will be necessary to carry out market research to identify buyers and valorization of each processed waste, for example the division between natural, synthetic, mixed fiber waste, just jeans, among others. With regard to training, the content can be applied by a scholarship holder from the DeSIn research group, a qualified student of Fashion Design courses or a professional in the area. The content must be applied in an expository way, bringing together small groups of cooperative members, so that analyses and practical tests are carried out to identify textile characteristics, such as a burning test to identify composition and analysis of the structure through a thread count. To facilitate the fixation and consultation of the content over time and during the day-to-day work, materials will be developed with the most important information to be used as guides, being an explanatory booklet and a collection of cataloged fabrics for consultation and comparison.

The training for people involved with the social enterprise (Creative Atelier) was planned with the support of the scholarship holders responsible for the product development subprojects, through the exchange of information regarding the skills needed for the production. Based on the activities planned for the Creative Atelier, the main objective of training for this work front is the development of creative skills, manuals for making and perception of which products and high added value textile waste can become. The skills in making were defined based on the step by step of the products made by the other fellows in the project and on their reports regarding the complexity of each product. Three low-complexity products were prototyped: a pet bed, a pillow and a pouf. The skills that need to be developed at the end of the training are: Autonomy in the use of the straight sewing machine; Autonomy in the use of the overlock sewing machine; Fabric cutting and modeling risk; Seal zippers; Nailing bias; Patchwork montage (a type of pattern with patchwork joining); Close products; Lining application; Application of shredded material (filling); Finishing on products. The content can be applied by any grantee of the project, student of Fashion Design or professional in the field of sewing, considering that they have experience in the area to be instructed. The training should preferably be carried out in person, in small groups so that the instructor can closely monitor the evolution of the participants. For the content to be better used and explained, it is recommended that more than one meeting be held, separating the practical activities into more than one block: construction of the product and then the participants will do in practice what was taught. As well as the training of the processing work front, explanatory booklets will be developed to illustrate the content and facilitate the fixation and consultation in the daily work. Finally, the training will include topics related to creative skills, so that the team can, in the future, develop new and own products.

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Table 1: Textile Waste Bank Equipament Price. Source: Prepared by the authors (2021)

	Fragmentadora de tecido	1	R$	26.000,00	R$	26.000,00
	Serviços industriais complementares (usinagem, prensagem, moldagem, etc)	1	R$	2.000,00	R$	2.000,00
	Prensa pneumática até 50t	1			R$	-
	Balança para 200kg	1	R$	700,00	R$	700,00
	Tesoura industrial	2	R$	80,00	R$	160,00
	Máquina de cortar tecido industrial	1	R$	700,00	R$	700,00
DESIGN	Prateleiras (prof. 40cm) para estoque (em metros)	5	R$	120,00	R$	600,00
Banco de	Mesas 200x80cm para separação de tecidos (tampo + pé)	3	R$	540,00	R$	1.620,00
Resíduos Têxteis	Bigbag 90x90x120	10	R$	50,00	R$	500,00
					R$	32.280,00

3.5. Implementation (preliminary results)

The effective implementation of the TWB system began with a meeting with the cooperative, in which the location for installing the equipment was defined, in one of the sheds that currently houses the cafeteria and the cooperative's library. A reallocation of the environments of this space will be made to accommodate the operation of the TWB. Simultaneously, the coordinators of the DeSIn group, in partnership with other researchers from UEL, submitted a project to search for resources through a specific public notice for Design and Innovation with the public state funding agency, in the second half of 2020. This project involves five different subprojects and was awarded a total of R$ 185.6 thousand, of which R$ 32.8 thousand were allocated to the implementation of the TWB. Currently, the resource is already released, and the equipment acquisition process has already started, according to table 1.

Of the items mentioned in Table 1, the most expensive is the equipment for textile waste fragmentation, which alone represents around 79% of the total available for acquisitions. This is equipment with few manufacturers in Brazil, all of which are micro-enterprises that produce only to order. This equipment, shown in figure 11, receives different denominations in the market, the most common being “scissors” and “shredding”. The approximate production capacity is 1,000 kg/day or 120 kg/hour, and the with an electric motor with a power of 30 HP, in addition to a protective fairing (figure 12) that protects the operator from moving parts such as pulleys and belts. The volume occupied by the machine is 2.3 x 1.2 x 1.2 m tall.

Considering the production capacity of this equipment, of up to 1,000 kg/day, a maximum production capacity of fragmented textile material can be estimated at around 20 tons/month, enough to make the TWB work viable; estimating a sales price of R$ 5.00/kg (similar to the market price of tow), it is possible to project a gross monthly income of approximately R$ 100,000.00 for the cooperative, which would be enough to remunerate the work of all cooperative members who will work in the system, currently estimated at five people; and still generate a financial reserve for the cooperative. The acquisition of this equipment is a key aspect of the TWB system, as it will allow the cooperative to have autonomy in the processing of the material, which, once fragmented, can serve as raw material for different types of products that can be produced, both in the Creative Atelier and by other companies. Companies that will buy this material from the cooperative. Thus, a new value chain is created from a material that until then is still considered waste by the municipality, and which has the city landfill as its final destination, that’s when it is not discarded in inappropriate places such as valley bottoms and vacant lots.

Figure 11: The fabric shredder in operation, without the fairing to visualize the engine, pulleys and belts. Source: Prepared by the authors (2021)

Figure 12: The fabric shredder in operation, with the protective fairing. Source: Prepared by the authors (2021)

4. CONCLUSION

The creation of solutions for the textile waste problem encompasses, as seen, different levels of design intervention, including communication, products, services, processes and systems; It also requires articulation with different actors and disciplinary fields, which adds a level of complexity to the process that, in the case of this project, was further exacerbated with the emergence of the Covid19 pandemic. This is the typical context of complex socio-technical problems, in which there is little control over the system and a need to adapt quickly to changes, without losing the initial objective of the project, which in this case is the reduction of environmental impacts and the revaluation of a waste combined with the creation of a new business and the generation of work and income. Such a challenge can easily take years to be faced, until it is possible to start an implementation, and this was (and is being) the case of this project as well, which only now sees a possibility of realization with the acquisition of equipment through public funding.

We conclude by reaffirming, based on the project presented here, our belief that it is possible to develop sustainability projects at a systemic level in Brazil, but we also reinforce to those who wish to develop this type of project that it is not something easy, simple, and much less fast. There will be setbacks along the way (and sometimes a pandemic...), and the research team will need to look for alternatives in order not to give up; but there will also be a moment when things start to happen, which proves to be the case with the Textile Waste Bank, TWB.

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