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ERGONOMIC ANALYSIS OF THE ACTIVITY: CRAFTING WITH FISHING RESIDUES

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Abstract

In the Northeast of Brazil, in the city of Cabedelo-PB, the Pérola Association has, as one of its main social interest initiatives, the promotion of local crafts. Women, members or guests of the association, organize themselves to share knowledge, teach, produce, and sell crafts made with shells and fish scales. The objective of this study was to conduct an ergonomic analysis to identify and propose solutions capable of promoting improvements in the activity of crafting with fish scales. The methodology used was ergonomic analysis, which allowed for a comprehensive understanding of the activity and facilitated the identification of variables that affect the female artisans' work. In this context, useful, practical and applicable improvement proposals were developed and proposals for positive transformation for the health of the female artisans were discussed, aligned with the efficiency of the production process. The study also takes into account external factors, such as the Sustainable Development Goals (SDGs 5, 8, and 12) from the United Nations 2030 Agenda. Therefore, the planned analyses of the activity led to a proposal for improvement focused on acquiring a work tool—electric scissors. It was estimated that electric scissors will facilitate the cutting of scales, reduce the physical effort of the female artisans (due to repetitive movements), and increase the efficiency of the handicraft production. Projections made showed that the tool could increase production efficiency by approximately 8%. As for the forecast, a 50% return on investment is projected.

Keywords: Ergonomics; Crafts; Fishing waste; Repetitive movements; Fish scales.

1. INTRODUCTION

In today's competitive scenario, ergonomics expands beyond its traditional focus on occupational health and safety, and can assume an organizational role directed to socio-technical systems, which start to involve organizational structures, policies and processes (Iida, 2005; Iida & Guimarães, 2016).

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Based on the perspective of Dul & Neumann (2009), ergonomics is undergoing a paradigmatic transformation, no longer being seen only as a field related to occupational health, safety and legislation, to assume a strategic role in contributing to the achievement of the objectives and success of organizations.

Ergonomics, also known as human factors, is defined *by the International Ergonomics Association* (IEA) as a scientific discipline concerned with understanding the interactions between humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design to optimize human well-being and overall system performance (IEA, 2024; ABERGO, 2024).

In this systemic context, a wide range of work activities are inserted, including handicrafts with fishing waste. According to Guérin et al. (2001), the work activity is the central element that organizes and structures the components of the work situation. It is capable of responding to the constraints determined externally to the worker, and at the same time it is capable of transforming them. Therefore, the technical, economic, and social dimensions of work only exist effectively as a function of the activity that puts them into action and organizes them in a given work situation (Iida, 2005; Vidal, 2012).

Thus, the direction of this study was based on the IEA definition mentioned above and on the contributions of Professor Vidal, who presents the following definition: "Ergonomics aims to modify the work process to adapt the work activity to the characteristics, abilities and limitations of people, aiming at their efficient, comfortable and safe performance" (Vidal, 2012, p. 15).

Ergonomics highlights the importance of balancing economic performance with workers' health (Daniellou, 2004). These aspects are examined under the concept of system, in which the elements interact continuously with each other. Therefore, the issues addressed by ergonomics are, in general, of a systemic and complex nature (Iida, 2005; Vidal, 2012). Therefore, it is essential that it is present in any work environment, contributing to the integration between health, performance and efficiency.

Ergonomics in handicrafts subsidized the in-depth understanding of the activity, allowing the identification and proposition of useful, practical and applicable improvements in order to promote positive transformations in the work of artisans. In addition, it was also considered to contribute to external and systemic factors involving the activity, such as SDGs 5, 8 and 12 of the UN 2030 Agenda, which aim respectively to ensure sustainable production

and consumption patterns, promote sustainable economic growth with decent work and ensure gender equality and women's empowerment (IPEA, 2018).

The production of handicrafts using fishing waste as the main raw material presents itself as an alternative to mitigate the negative impact caused by the improper disposal of these materials in inappropriate places, such as dumps, landfills, dam banks and improper environments (Costa et al., 2016; Freitas et al. 2024).

The use of scales as a raw material for handicrafts, combined with the reuse of waste, represents a practice that is still not widespread in Brazil, however, it has already been based on scientific research and academic extension projects (Costa et al., 2016; Guilherme et al., 2021). In this context, researchers Costa et al. (2016, p. 13), evaluate scales as a product of "high quality and durability", which can be used in the creation of various handicrafts.

In the work of artisans, there is a lack of visibility of the health problems of these workers in relation to the specific diagnosis of Repetitive Strain Injuries (RSI). The current protocol for the diagnosis of RSI, published by the Ministry of Health, focuses mainly on the context of industrial or service wage labor (Pena & Martins, 2014).

Repetitive Strain Injuries (RSI) have been widely reported as the main occupational diseases in the developed world, due to the implementation of new production processes, the dissemination of information technology and various forms of precarious employment that demand accelerated rhythms (Pena & Martins, 2014). In relation to this scenario, it is important to observe the evolution of notifications over the years in "Brazil, between 2007 and 2016, 67,599 cases of RSI/WMSD were reported, representing a growth of 184% in the period" (Mazzoni, 2023, p.81).

According to INSS/DC Normative Instruction No. 98, of December 5, 2003, the high prevalence of RSI/WMSD has been explained by transformations in work and companies. These have been characterized by the establishment of goals and productivity, without taking into account workers and their physical and psychosocial limits (BRASIL, 2003).

In the context of work-related diseases, the Italian physician Bernardino Ramazzini (2000) is recognized as one of the pioneers of occupational medicine and published the book *De Morbis Artificum Diatriba* (Workers' Diseases). It is relevant to note that Ramazzini already provided evidence of Repetitive Strain Injuries (RSI) in his book when analyzing diseases among scribes and notaries. He cited the case of a notary who, after dedicating his entire life to

writing, developed weakness in his arm followed by complete paralysis due to repetitive movement of the hand when writing (Ramazzini, 2000).

Work activities can have consequences and affect the health of workers. To understand the origin of RSI/WMSD, one must bear in mind the importance of applying ergonomic analysis. According to Professor Vidal (2011), ergonomic analysis allows a diagnosis of the work situation that takes into account the variabilities of the system and the adjustments made by the operators.

Ergonomics, focusing on people's work activity, has as its object the work situation and, as its purpose, the transformation to improve the context in which the execution of this activity occurs (Vidal, 2012; Wisner, 2004). In this sense, the Ergonomic Analysis of Work (AET) stands out.

> AET (Ergonomic Analysis of Work) goes through a reinterpretation of the work situation, this new vision seeks, through the knowledge of the activity, to transform work in the sense of expanding the spaces of regulation and cooperation, thus, it is necessary that the models proposed by ergonomics have the ability to concomitantly promote knowledge and action. (Tonin, Menegon, & Camarotto, 2015, p. 134).

Therefore, understanding the strategies used by operators to manage variabilities in system performance is necessary for a good ergonomic analysis of the work. This is because the operator, in the face of variability, develops regulation and anticipation strategies capable of masking the observable manifestations and meeting what the organization expects of him (Vidal, 2012).

Thus, the great challenge for ergonomists is to act in the positive transformation of work situations, promoting a balance that makes them compatible with both the comfort and health of workers and the economic effectiveness of organizations.

2. MATERIALS AND METHODS

The methodology followed for this study to meet its objectives was the "Ergonomic Analysis" (Vidal, 2012, p. 12). The observational and interactional methods supported the global and systematic analysis of the ergonomic analysis.

The observational method used was open observation, supported by photographic records, filming and on-site notes . The interactional methods used were consolidated as the trust between the researcher and the subjects was established. In this context, the social construction developed and facilitated the opening to additional resources, such as conversational actions, provoked verbalizations, interviews and the application of semi-

structured questionnaires. Regarding the way to approach the problem, it was a qualitative research. And as a procedure, a case study was carried out.

3. RESULTS AND DISCUSSIONS

This section presents and analyzes the data from the ergonomic analysis, discussing them based on the literature and highlighting improvements for artisanal activity with fish scales.

3.1. Managerial demand

In December 2023, the researcher from the GAE (Ergonomic Action Group) visited the Pérola Association. She presented the scope of the ergonomics research to be developed in partnership with the organization. On the occasion, the first referrals were made, and the researcher was invited to visit the 37th Paraíba Handicraft Show, an event where artisans exhibit and sell pieces produced with fishing waste.

On 02/04/2024, during the 37th Paraíba Handicraft Show, the researcher developed a conversation with the association's project coordinator and with the artisans/instructors of handicrafts with fishing waste. During this interaction, topics related to handicrafts and waste, the organization of work in handicrafts, health and safety, with subsequent correlation with ergonomics, were discussed. From this context and the experiences shared by the artisans, a managerial demand was identified: physical problems, especially in the hands and fingers of the artisans.

3.2. Social construction

Social construction seeks, by its very nature, to directly assist those involved in the implementation of the ergonomic solution (Vidal, 2012). Through the social construction carried out, it was possible to form groups of people involved and committed to the advancement of handicrafts made with fishing waste. In this research, the social construction was initiated from the formation of the itinerary of contacts and the meetings held in the field.

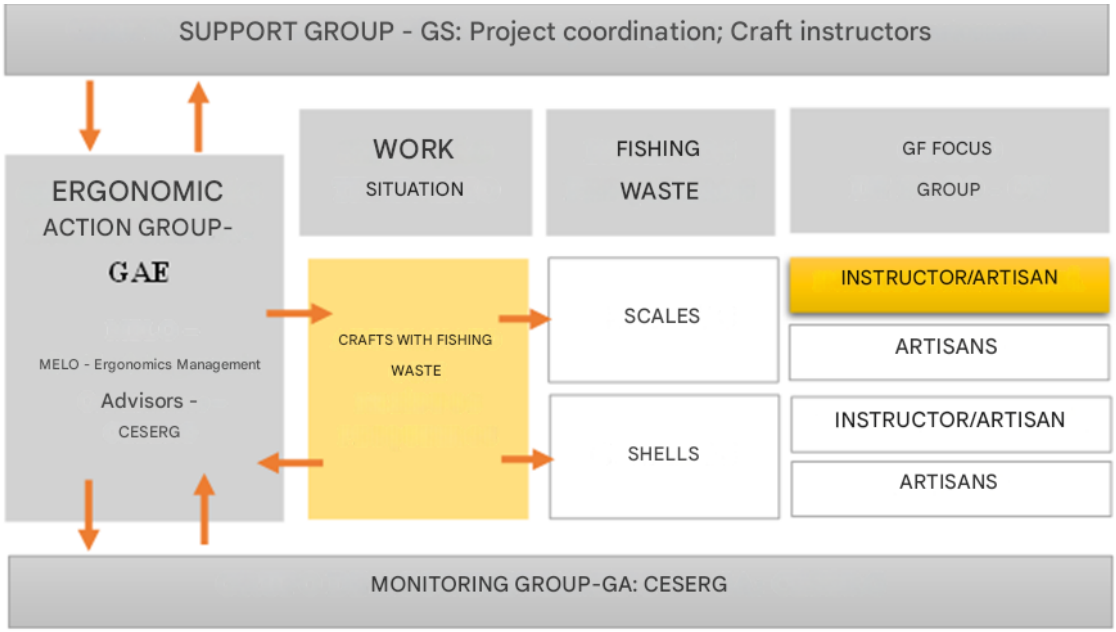
The groups that formed the social construction (SC) are composed of people who are involved with the work situation, and participate in the collection of data, acquisition of information and construction of knowledge about the activity in question. The social

construction device presents the following groups: Ergonomic Action Group (GAE); The Support Group (GS); The Monitoring Group (GA); The Focus Groups (FG).

- Ergonomic Action Group (GAE) formed by people who have knowledge in ergonomics and an approach centered on the activity of craftsmanship. The GAE includes a researcher and graduate student, who took a specialization course in Ergonomics Management and is pursuing a doctorate in Production Engineering at UFRJ, in addition to professors from CESERG;
- Support Group (GS), is formed by the person who holds the decision-making power in the work situation, that is, the association's project coordinator and artisan instructors;
- Monitoring Group (GA), is formed by the person who has technical power, that is, CESERG professors who guide the ergonomic analysis in action;
- Focus Groups (FG) are formed by artisan instructors who work with scales and shells and contributed to the collection of data and information about the activity.

The focus group chosen to analyze the activity of handicrafts made with fishing waste was the FG instructor who works with scales. As shown in figure 1.

Figure 1 – Schematic of the ergonomic action social construction device



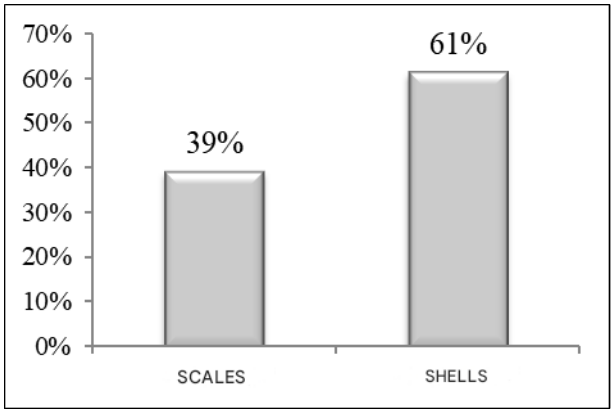
Source: Adapted from Vidal, 2012, p.70.

3.3. Global analysis

In the Northeast of Brazil, in the city of Cabedelo-PB, Associação Pérola, founded 23 years ago, is a non-profit organization whose mission is to defend causes related to human rights, equal rights and the collective interests of shellfish gatherers and fishermen. Among its main initiatives of social interest is the promotion of local handicrafts, which promotes female autonomy and empowerment.

Women, members or guests, of the Pérola Association, organize themselves in groups to share learning, teach, produce and sell handicrafts made with fishing waste. Among the most produced and marketed products, decoration items made with scales and shells stand out. Graph 1 represents the percentage of women involved in handicrafts as a function of the main raw material, shells and scales. It is noticed that most artisans (11 women) use shells as fishing waste to produce their handicrafts, corresponding to 61%. Next, it is observed that 39%, which means 7 artisans, use fish scales.

Graph 1 – Classification of artisans by raw material of handicrafts



Source: Field research, 2024.

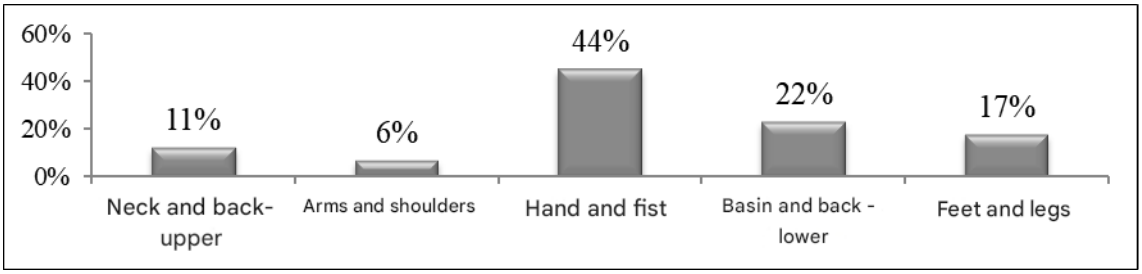
In March 2024, the Pérola das Águas group brought together a total of 18 women, including members or guests of Associação Pérola. Together, they dedicate themselves to the art of handicrafts, using fishing waste as raw material. In addition to producing and marketing their pieces, these women share knowledge, teach and inspire each other.

On April 17, 2024, a semi-structured questionnaire was applied to the artisans, accompanied by the respective consent records for participation. The research instrument ensured the anonymity of the participants. The research was carried out with 18 artisans, all female and aged between 43 and 70 years. Part of the questionnaire applied involved an adaptation of the "Nordic Questionnaire of Musculoskeletal Symptoms" (Iida. 2005, p.174). One of the questions addressed to the artisans was: Have you had any health problems in the

last 7 days? The results revealed that 67% of the artisans mentioned having felt discomfort or pain in the last 7 days.

It was found that the most affected areas were the hands and wrists, with a significant index of 44% of discomfort. Next, the following regions stood out: pelvis and lower coasts, with 22%; feet and legs, with 17%; neck and upper back, with 11%; and, finally, arms and shoulders, with 6% (Graph 2).

Graph 2 – Musculoskeletal symptoms



Source: field research, 2024.

The answers obtained in the questionnaires indicated a possible relationship between an external factor linked to the work activity and the health of the artisans. On April 7, 2024, the second stage of the Velejar Project took place in the city of Cabedelo, PB. Associação Pérola received an invitation from the municipal secretariat to exhibit and sell its handicrafts during this event. The artisans interested in participating mobilized to increase their production, aiming to expand the exhibition and commercialization of their products during the event.

The Nordic questionnaire was administered on 17 April 2024. It was observed that this occurred 10 days after the event on April 7, 2024. This external factor, the event, may have imposed or added requirements to the work activity, generating operative regulations. These regulations provided insights into the discomforts and pains faced by artisans over the past seven days, in specific areas of the body, such as the hands.

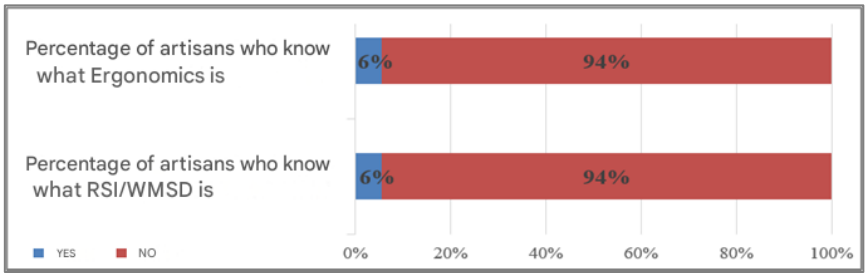
Health and safety in the workplace are topics of great relevance, especially for professional categories such as artisans, who face challenges related to the repetitiveness of activities. In this context, graph 3 presents two questions directed to the artisans:

- Have you ever heard of Ergonomics?
- Do you know what RSI/WMSD is?

The results of these questions indicated an opportunity to disseminate the concept of Ergonomics, since 94% have no knowledge about this multidisciplinary discipline. They also

revealed that 94% are unaware of what RSI/WMSD is, emphasizing the importance of promoting injury prevention and the creation of safer work environments through the dissemination of these concepts. The survey also pointed to a significant commitment of artisans to health in the workplace, since 100% of them showed interest in learning more about the subjects.

Graph 3 – Questions related to ergonomics



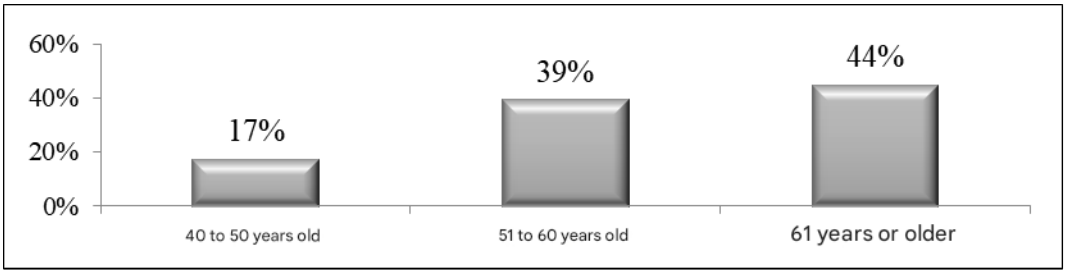
Source: Field research, 2024.

3.3.1. Profile of the artisans

To understand the characteristics of the group studied, a set of variables that reflect the profile of the artisans was analyzed. Among them, the gender variable stood out, which revealed important aspects about the representativeness and participation of women in the analyzed context. The analysis of the gender variable showed that among the 18 participants in the group, all artisans are women, corresponding to 100% of the total. This female predominance highlights the essential role they play, both in the practice of handicrafts and in the sustainable management of fishing waste.

The age profile of the artisans in the group revealed a significant distribution in different age groups. Among the participants, 3 women are in the age group of 40 to 50 years, representing a smaller portion of the group. On the other hand, most of the artisans, a total of 7, are in the range of 51 to 60 years old, indicating a significant presence in this age group. In addition, a significant number of 8 women are 61 years old or older, denoting a considerable participation of more experienced artisans (Graph 4).

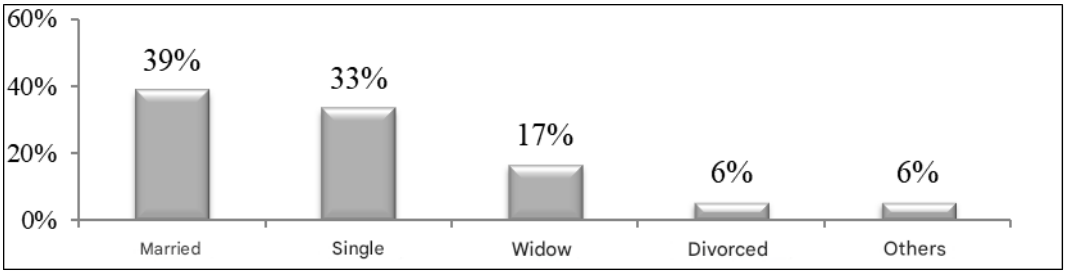
Graph 4 – Age group of the artisans



Source: Field research, 2024.

Graph 5 shows the distribution of marital status among the artisans. It was found that most are married, totaling 39% of the group. These data suggest that family responsibilities associated with the marital status of being married may have influenced the low level of education among the artisans, possibly making it difficult to continue their studies. In addition, 33% are single, 17% are widows, 6% are divorced and 6% belong to other categories.

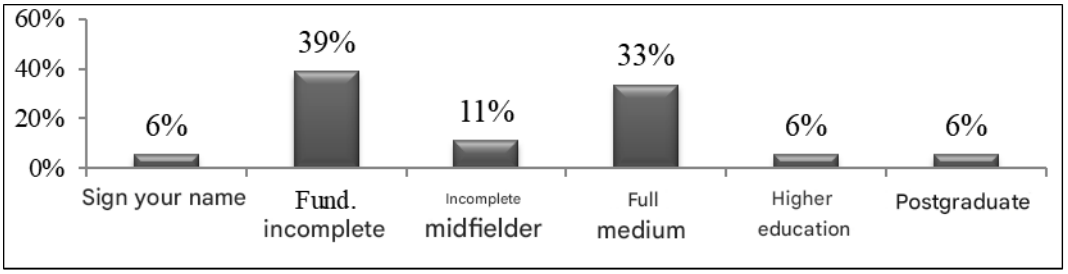
Graph 5 –Marital status



Source: Field research, 2024.

It can be seen in graph 6 that most of the artisans completed elementary school, totaling 39% of the group, which corresponds to 7 women. Next, 33% have completed high school, while 11% have incomplete high school. In addition, 6% of the artisans only have the ability to sign their own name. In the context of low education, the factor of family responsibilities assumed by the artisans and financial difficulties were raised, by the majority, as the obstacle to the continuity of studies. The other categories of education, such as higher education and graduate studies, correspond to 6% each.

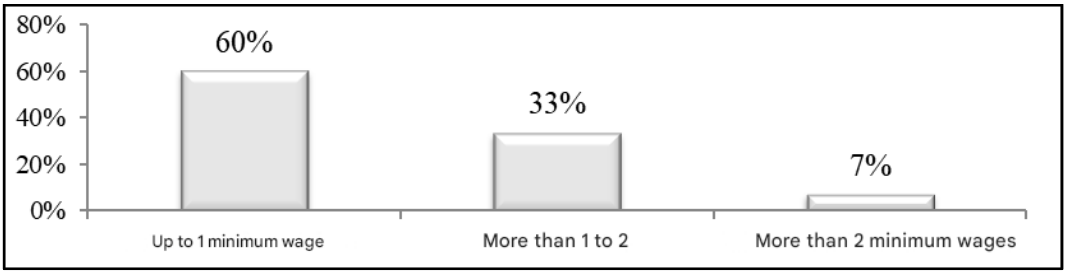
Graph 6 – Educational level



Source: Field research, 2024.

Graph 7 shows the distribution of income among the members of the group. The data reveal that half of the artisans, totaling 50%, receive a monthly salary of up to 1 minimum wage. This salary reality suggests the presence of significant financial challenges for a considerable portion of the participants. On the other hand, approximately one third of the artisans, corresponding to 33%, have incomes between 1 and 2 minimum wages. In addition, 17% of artisans have a monthly income of more than 2 minimum wages.

Graph 7 – Household income



Source: Field research, 2024.

3.4. Ergonomic demand

The global analysis and the social construction made it possible to reconstruct the managerial demand, directing the choice of the following ergonomic demand: Repetitive Strain Injuries (RSI).

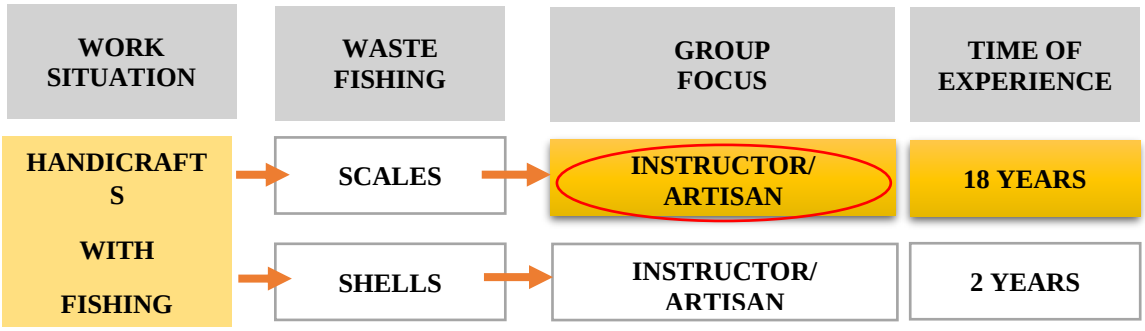
3.5. Artisanal activity with fish scales

After defining the ergonomic demand, the activity of the artisan instructor who works with the fishing waste, in this case the scales, was chosen as the focus for the ergonomic analysis (Figure 2).

3.5.1. Micro population analysis

The micro population of this study includes the artisan instructor, who teaches, makes and sells handicrafts made with fish scales. This choice was made intentionally, and the criteria used were: repetitive work and years of experience in the activity of handicrafts with fishing waste.

Figure 2 – Micro population analysis



Source: Survey authors, 2024.

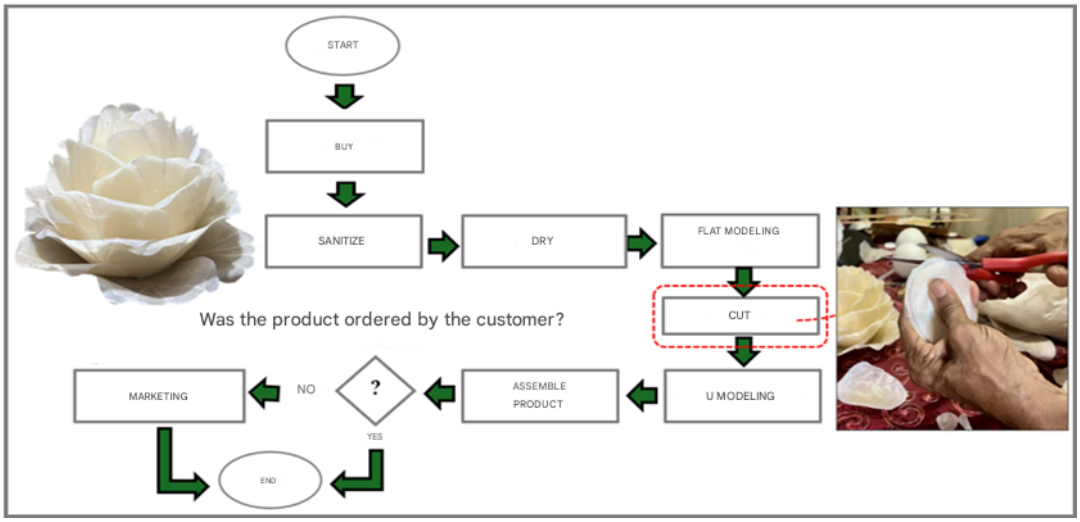
The selected artisan has technical training in handicrafts with scales and is experienced in the use of camurupim fish scales (*Megalops atlanticus).* At 68 years of age, she has a decade of experience as an instructor and 18 years as an artisan. His expertise and long-lasting trajectory in the activity are reflected in his speech, which offers evidence about his work over the years: "[...] I'm an artisan and I'm an instructor... I teach workshops on how to make products with scales. I have trained an average of 200 people since 2014. I passed on and pass on this work that God showed me [...], I have a great love for the scale" (Artisan/instructor).

The artisan, in addition to the workshops she teaches, sells her products at fairs, craft salons, events and direct sales to the consumer. The production of the flower, called by the artisan as "artichoke flower" is the standard product taught in the workshops, and is also the most demanded by customers during marketing.

3.5.2. Craftsmanship: artichoke flower

The production of artichoke flower is the flagship of the artisan's work (Figure 3; Appendix). Its making involves a series of different activities, they are: scale modeling in flat format; cutting scales; model U-shaped scale, Glue and assemble piece.

Figure 3 – Flowchart of the artisanal production process with scales



Source: Survey authors, 2024.

The production of a piece of artichoke flower requires the use of 30 scales, and all scales go through the four activities, which consequently implies repetitive movements (Table 1). In aggregate, these operations result in a total period of 55 minutes for the completion of a piece of artichoke flower.

Table 1 – Times for making products made with scales

PRODUCT	SCALES	ACTIVITIES	CURRENT WEATHER	TOTAL TIME
FLOWER	30	Flat scale modeling **Cut** U-shaped scale modeling Glue and assemble part	12’ **8’** 15’ 20’	55 minutes
CHANDELIER	1500	Flat scale modeling **Cut** U-shaped scale modeling Glue and assemble part	600’ **400’** 750’ 1000’	2,750 minutes or 45.80h

Source: field research, 2024.

The amount of repetitive movements was evidenced in the respective execution times of the steps for the construction of the artichoke flower and its by-products. The production of a chandelier, for example, requires the use of 50 flowers, which implies 1500 scales worked. Therefore, the production of the chandelier demands a notable increase in repetitive movements. In aggregate, these operations result in a total period of 45.80 hours for the completion of the flowers necessary to compose a single chandelier.

According to the parameter used by the French Ministry of Health, cited by Pena & Martins (2014, p. 79-80) as a reference to characterize the ergonomic risk related to the overload of repetitive movements in craft activities, workers who undergo "more than 20 hours a week

of repetitive movements, concentrated in the joints, are exposed to the risk of musculoskeletal disorders".

In handicrafts with scales, to meet a single request for flowers to compose a chandelier, the artisan makes 50 artichokes. This work demands more than 20 hours per week, resulting in an overload of repetitive movements concentrated on the hands. Consequently, working at this pace for only two days a week, the artisan is already completely exposed to the risk of developing Repetitive Strain Injuries (RSI). As she reports: "I know I'm in so much pain because I recognize that I overdid it. I made 13 artichokes from separating, modeling, cutting and assembling, in 12 hours straight [...] I've been paying the price with these pains for more than 10 days" (Artisan/instructor).

Regarding time management, the artisan manages her own work, allowing herself to adjust her time and activities as needed. In case of pain due to repetitive efforts, she can interrupt the activity to recover. However, financial needs force her to continue working to support herself and her family. Thus, the more products it makes, the greater its income from the sale of these items.

Therefore, the regulations imposed by the activity, both internal and external to the system, can result in constraints for the artisan, subjecting her hands to excessive efforts, which can become a source of injuries or occupational diseases.

3.6. Diagnosis

After the analyses carried out, the operating model of this study proposed the acquisition of an electric scissors in order to increase productivity and reduce repetitive movements during the production process of handicrafts with scales and, consequently, it is assumed that it would avoid Repetitive Strain Injuries - RSI (Figure 4).

Figure 4 – Electric scissors

SPECIFICATION

Motor: All copper core motor;
Voltage: DC3.6V;
Battery capacity: 2000mah (built-in battery);
Charging mode: DC direct charging (5.5x2.1mm), 100~240V;
Rotational speed: 11000r/min;
Cutting capacity: cotton fabric 8mm, leather products 6mm, vinyl building fabric 4mm, rubble cardboard 6mm, cardboard 4mm, plastic (PVC) 3mm, aluminum foil 1mm;
Charger: AC110~220V / USB charging.

Source: Hormy, 2024.

3.7. Economics of Ergonomics

It is estimated that with the implementation of the electric scissors there will be a reduction in the total production time of the artichoke flower from 55 minutes to 51 minutes. It is projected that with the use of scissors there will be a reduction of approximately 50% in the time required for cutting.

Therefore, it is estimated that, after the implementation of the tool, the time required for the production of pieces that use artichoke flowers, such as the chandelier, will be substantially reduced from 45.80 hours to 42.5 hours. This reduction will allow the artisan to save approximately 3.55 hours (or 213 minutes) of labor.

With the time savings in the cutting stage, it is projected that the artisan can produce up to 4 additional pieces, resulting in an increase of about R$ 200.00 in the final value obtained. In total, it will be able to produce 54 pieces, totaling a value of R$ 2,700.00 (Table 2).

Table 2 – Financial data and estimates

SITUATION	Value per Piece (R$)	Quant. Parts produced	Quant. Additional parts produced	Additional value (R$)
Before investment	50	50	-	-
After investment (estimate)	50	54	4	200

Source: field research, 2024.

The proposed improvement suggestion for the activity involves an investment of R$ 150.00, but will allow an additional gain of R$ 200.00 in its revenue. Therefore, the ROI for the project was calculated at 50% on the investment.

4. CONCLUSIONS

The detailed analyses of the activity supported a proposal for improvement aimed at the acquisition of a work tool, electric scissors. The proposal for improvements applied to the reality of handicrafts with scales aimed to reduce the physical effort of the artisans (repetitive movements) and increase efficiency in the production of handicrafts. During the validation and restitution meeting with the interested parties, the proposal for the acquisition of the electric scissors was well accepted, and the purchase of the product was carried out. Projections indicate that the tool can increase production efficiency by approximately 8%. As for feasibility, a probable return of 50% on the investment is calculated.

After completing the methodological steps of the ergonomic analysis, this research also provided an understanding of the handicraft activity with fishing waste and the factors external to the system that interact with this activity, such as SDGs 5, 8 and 12 of the UN 2030 Agenda.

In this study, SDG 12 was contemplated by the importance of reducing waste through recycling and reuse. As well, it is in line with Law No. 12,305/2010 - National Solid Waste Policy (PNRS). SDG 8 addressed ergonomics in craftsmanship to reduce physical strain and injuries while improving productivity. SDG 5 is supported by Associação Pérola, which organizes workshops to train women in handicrafts with fishing waste, promoting their autonomy and economic participation, and contributing to gender equality.

As a suggestion for the continuity of the study, the practical application of electric scissors and the comparison to prove that the cutting time of the activity was really reduced was highlighted. For a greater positive contribution to the activity, it is relevant to develop a scale modeling tool, capable of reducing repetitive movements in other activities: flat scale modeling and U-shaped scale modeling. It is believed that the greater the reduction in activity times, through the intervention of useful projects, practical and applicable, the greater the reflection in tangible benefits for the health of the artisans and in the efficiency of the production process.

REFERENCES

Associação Brasileira de Ergonomia. (2024). *O que é ergonomia*. https://www.abergo.org.br/o-que-%C3%A9-ergonomia

Brasil. (2003, 5 de dezembro). Ministério da Saúde. Instrução Normativa INSS/DC nº 98 – Anexo - Seção I – Atualização clínica das Lesões por Esforços Repetitivos (LER) Distúrbios Osteomusculares Relacionados ao Trabalho (DORT). *Diário Oficial da União*, Brasília.

Costa, W. M., Vidal, J. M. A., Veiga, M. C. M., Rodrigues, J. M., & Santos, J. F. (2016). Aproveitamento de resíduos de pescado: o artesanato com escamas de peixe. *Revista Ciência em Extensão, 12*(2), 8–17. https://ojs.unesp.br/index.php/revista_proex/article/view/1239/1226

Daniellou, F. (2004). Questões epistemológicas levantadas pela ergonomia de projeto. In F. Daniellou (Org.), *A ergonomia em busca de seus princípios* (pp. 181–198). São Paulo: Edgard Blücher.

Dul, J., & Neumann, W. P. (2009). Ergonomics contributions to company strategies. *Applied Ergonomics, 40*(4), 745–752. https://doi.org/10.1016/j.apergo.2008.07.001

Freitas, M., Santana, R., & Silva, G. (2024). Artesanato com escamas de peixes: uma alternativa para o descarte de resíduos de pescado e agregação de renda para pescadoras de comunidades pesqueiras tradicionais. *Revista Extensão e Cultura da UFRB, 25*(1), 108–119. Recuperado de https://periodicos.ufrb.edu.br/index.php/revistaextensao/article/view/3500

Guérin, F., Kerguelen, A., Laville, A., Daniellou, F., & Duraffourg, J. (2001). *Compreender o trabalho para transformá-lo: A prática da ergonomia*. São Paulo: Edgard Blücher.

Guilherme, B. C., Silva, J. L. C., Morais, R. N., Bezerra Júnior, J. C., Vidal-Campello, J. M. A., & Costa, W. M. (2021). Educação socioambiental na escola: olhares sustentáveis sobre os resíduos oriundos da pesca e mariscagem. *Revista Brasileira de Meio Ambiente, 9*(1). https://www.revistabrasileirademeioambiente.com/index.php/RVBMA/article/view/780

HORMY. Tesoura elétrica (2024). Recuperado de https://pt.aliexpress.com/i/1005005459594346.html

Instituto de Pesquisa Econômica Aplicada. (2018). *ODS - Metas Nacionais dos Objetivos de Desenvolvimento Sustentável: Proposta de adequação*. https://bit.ly/2oJPWy0

International Ergonomics Association. (2024). *What is ergonomics?* https://iea.cc/what-is-ergonomics/

Iida, I. (2005). *Ergonomia: Projeto e produção* (2ª ed.). São Paulo: Blücher.

Iida, I., & Guimarães, L. B. M. (2016). *Ergonomia: Projeto e produção* (3ª ed.). São Paulo: Blücher.

Mazzoni, C. F. (2023). Distúrbios osteomusculares relacionados ao trabalho. In R. Rocha & L. M. Baú (Orgs.), *Dicionário de ergonomia e fatores humanos: O contexto brasileiro em 110 verbetes* (pp. 25–27). Rio de Janeiro: ABERGO.

Pena, P. G. L., & Martins, V. L. A. (2014). Riscos de doenças do trabalho relacionadas às atividades de pesca artesanal e medidas preventivas. In P. G. L. Pena & V. L. A. Martins (Orgs.), *Sofrimento negligenciado: Doenças do trabalho em marisqueiras e pescadores artesanais* (pp. 93–132). Salvador: Edufba.

Ramazzini, B. (2000). *As doenças dos trabalhadores* (R. Estrêla, Trad., 3ª ed.). São Paulo: Fundacentro.

Tonin, L. A., Menegon, N. L., & Camarotto, J. A. (2015). Busca ativa: contribuições para o projeto desde a análise da demanda. *Revista Ação Ergonômica, 10*(1), 133–142.

Vidal, M. C. (2012). *Guia para análise ergonômica do trabalho na empresa*. Rio de Janeiro: Editora Virtual Científica.

Wisner, A. (2004). *Textos escolhidos de antropotecnologia* (J. M. B. Carvão & A. Nascimento, Trad.; M. C. Vidal & J. M. Carvão, Orgs.). Rio de Janeiro: Editora Virtual Científica.

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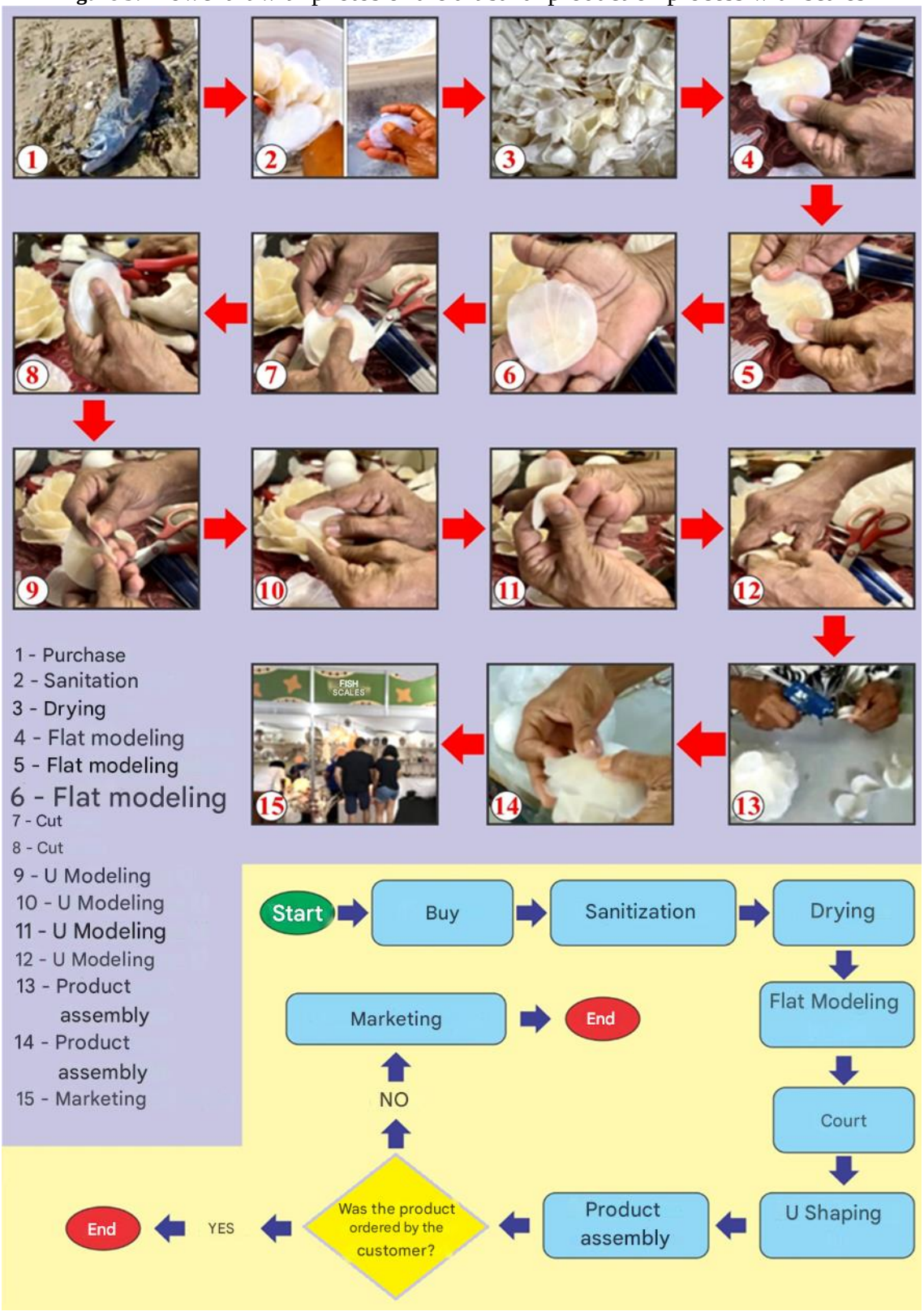
APPENDIX

Figure 5: Flowchart with photos of the artisanal production process with scales



Source: Survey authors, 2024.