

**REWEART - A 100% REAL CIRCULAR ECONOMY MANUFACTURING  
PROCESS FOR VEGAN-ORGANIC-RECYCLED FOOTWEAR**

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The negative impact on the environment caused by the current production of over 23,000 million pairs of shoes each year, either due to the consumption of huge quantities of raw materials or due to the thousands of tons of waste generated, is a sufficient reason to conceive a new type of shoe making process. The predominant manufacturing methods and the many components that the shoe contains make it impossible to recycle, due to the high complexity involved in separating materials. Once they reach the end of their life cycle, they inevitably end up in a landfill, generating a large amount of waste. REWEART is a footwear manufacturing project that is capable of producing sustainable goods based on a circular economy, co-financed by the European Commission through the LIFE program. REWEART aims to make vegan shoes with accessories made from recycled and organic materials, with 90% less energy and almost zero waste. REWEART wants to provide a tool to avoid the generation of waste in footwear consumption and to offer the footwear industry an alternative model of circular production to reduce energy consumption and to stop the destructive and unsustainable production of footwear.

Keywords: vegan, organic, recycled footwear.

## **INTRODUCTION**

REWEART is a LIFE project co-financed by the European Commission that aims to develop a new business model to create new 100% recycled, organic footwear.

Project duration: 01.09.2018-30.06.2021.

## **AIMS & OBJECTIVES**

- The REWEART project aims to demonstrate a new model of footwear production in order to reduce the consumption of resources and waste in the textile and footwear sectors;
- The REWEART project aims to guarantee the transferability and replicability of footwear production;
- The project also aims to provide tools to the public administration for the evaluation of footwear manufacturing policies and strategies;
- Another objective of the REWEART project is to increase the awareness and support of the footwear sector;
- It also aims to identify and involve all relevant stakeholders related to footwear production issues.

## **CONSORTIUM**

The consortium was created based on the combination of different environments, experience and expertise of the partners, includes all the skills, recognized expertise and competences needed to achieve all aspects of the work program. The consortium includes 6 institutions from 3 countries.

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There is a mixture of institutions with different profiles, capacities and complementary competences suitable for the development of the work program (companies, research centers).

Most of the partners have experience in implementing transnational projects, which must accomplish all aspects of the project work program and complement each other in terms of their role in the project. In this way, the project provides for a stable partnership.

### PROJECT PARTNERS

- ✓ INCDTP – Division: Leather and Footwear Research Institute (ICPI) (Romania) – *Coordinator*;
- ✓ ATEVAL (Spain);
- ✓ FERRE AGRUPACIÓN, S.A. (Spain);
- ✓ HILATURAS FERRE, S.A. (Spain);
- ✓ MUSTANG, S.R.L. (Italy);
- ✓ VESICA PISCIS FOOTWEAR, S.L. (Spain).

### ACTIONS AND MEANS INVOLVED

The project includes a set of implementation activities that will materialize the project objectives, supported by training, management, quality and dissemination activities that will ensure the wide distribution of its results even after the end of the project.

Actions and means to achieve the objectives are organized as follow:

- Implementation actions encompass actions to enable transferability and replicability by means of technical courses to public administration and professionals and guidelines to support the identification and the “know-how” to implement the suitable technique in each case. The main demonstration activities are: complete engineering design of REWEART system starting with the selection of basic components of the garment recycling process; building of a pilot on vegan, recycled-organic shoes; implementation of a REWEART platform and ICT tools; recycling of soling materials, mainly rubber for outsoles and playgrounds; produce footwear maker replication of the model of organic-vegan/recycled footwear.
- Monitoring actions include different methodologies to measure the environmental, social and economic impacts of the project.
- Public awareness and dissemination actions (D) include activities to involve all relevant stakeholders.
- Results will be disseminated by using project website and collaborators and other networking tools (Facebook, Twitter). Peer reviewed international publications will be also provided. Participation at national and international conferences and events will be foreseen. Specific dissemination material will be designed, produced and distributed to all relevant stakeholders and general public. The dissemination actions encompass an itinerary with information panels about the techniques and expected results. A Post LIFE communication plan is considered where commitments acquired by the partners regarding the continuation of the project will be included.
- The coordination of actions and involved partners is crucial in this project due to the interdependences among the proposed actions.

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## EXPECTED RESULTS

The REWEART project will demonstrate the concept of complete recycling of footwear and clothing properly and their reuse as components for the creation of new items.

All materials used for project trials will be organic, chemicals free and animal free, so we want to achieve a product 100% ORGANIC, VEGAN and RECYCLED, achieving modest sales of 30.000 pairs during the first year after project end.

The following innovative results will be obtained through the REWEART project:

- Creating a service-oriented framework that is willing to produce footwear based on “Eco-Design”;
- Methods and processes for the development of recyclable or reusable products (i.e. new design and assembly methods based on modularity and which allow easy disassembly);
- Methods for assessing recyclability, taking into account resource consumption, waste generation and cost impact;
- ICT tool to support advanced 3D configuration of products;
- Development of comprehensive, innovative and practical “Eco-Design” decision-making applications, for better informed consumers.

## ACTIVITIES AND RESULTS

### Specifications and Component Selection

*Phase 1* - The basic models were designed and the components were selected. 30 models were initially evaluated and subsequently modified (Fig. 1). It has been established that the outer sole would be made of LATEX.

Style name	Picture	Composition	Comments
Rewart - P1		100% recycled cotton - Latex crepe sole	Outsole too soft, problems in premanufacturing the outsole
Rewart - P2		100% recycled cotton - Latex crepe sole	Outsole too soft, problems in premanufacturing the outsole
Rewart - C1		100% recycled cotton - Latex crepe sole	Outsole too soft, problems in premanufacturing the outsole
Rewart - C2		100% recycled cotton - Latex crepe sole	Outsole too soft, problems in premanufacturing the outsole
Rewart - C3		100% recycled cotton - Latex crepe sole	Outsole too soft, problems in premanufacturing the outsole
Rewart - C4		100% recycled cotton - Latex crepe sole	Outsole too soft, problems in premanufacturing the outsole
Rewart - C5		100% recycled cotton - Latex crepe sole	Outsole too soft, problems in premanufacturing the outsole

Figure 1. Basic models

*Phase 2* - Two types of “helmet” soles were chosen (one white and one green) made of SBR + EVA (styrene-butadiene copolymer + ethylene-vinyl acetate copolymer). Both cause problems in that they contain stearic acid of animal origin as a vulcanizing

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agent. The tests performed at ICPI show that the green sole is more sustainable. It has up to 70% recycled rubber and synthetic rubber.

*Phase 3* - Research and tests on the composition of the soles.

*Phase 4* - In this phase, life cycle analysis information is collected, each component is weighed for size number 42: lining, upper, laces, yarns, sole, insole, adhesive, box. Also, the composition of each component is established.

### PILOT STATION Initiation Demonstration

REWEART manufacturing process proposed for the vegan shoes, is based on the STROBEL lasting system, which consist on the attachment of a non-woven textile to the upper by stitching. After this, the assembly of the upper material to the sole is done by stitching, with minimum use of adhesive, water based anyway.

With this approach, we propose a prototype line consisting on a cutting machine, two/three types of stitching machines (upper and lining assembly and side stitching) and then just a lasting station by hand and an upper-sole joining with pressure and final stitching.

The PILOT STATION for manufacturing footwear was developed (Fig. 2).

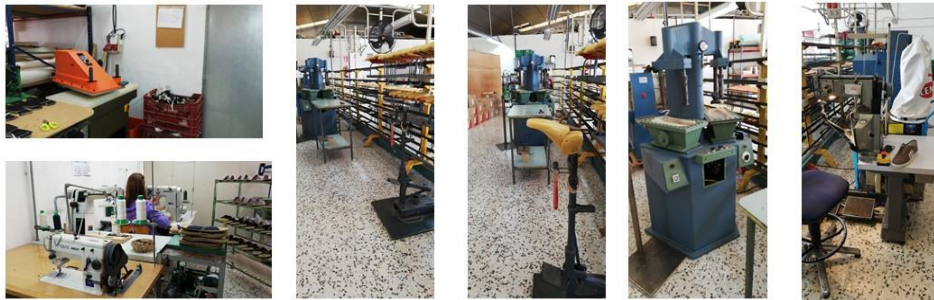


Figure 2. PILOT STATION

### Demonstration and Validation of the Pilot Installation for Recycling Clothes and New Yarns

Yarns were developed from recovered fibers from technological waste, waste from the population, whether or not mixed with conventional or organic virgin cotton fiber, for which a presence of less than 5% was accepted and other unspecified fibers was taken over by partners with textile yarn processing profile.

The selection of yarn variants, within the project, was made taking into account 2 vectors of textile yarn processing requirements:

- requirements known per se, of the project, in accordance with the specific objectives,
- specific requirements for the production of textile components of footwear products.

Various fabrics were developed (Fig. 3, Fig. 4) that are still in testing: tensile strength and elongation, tear strength, abrasion/ friction resistance, pilling effect, seam strength, air permeability, resistance on surface hanging, fibrous composition of the woven fabrics.

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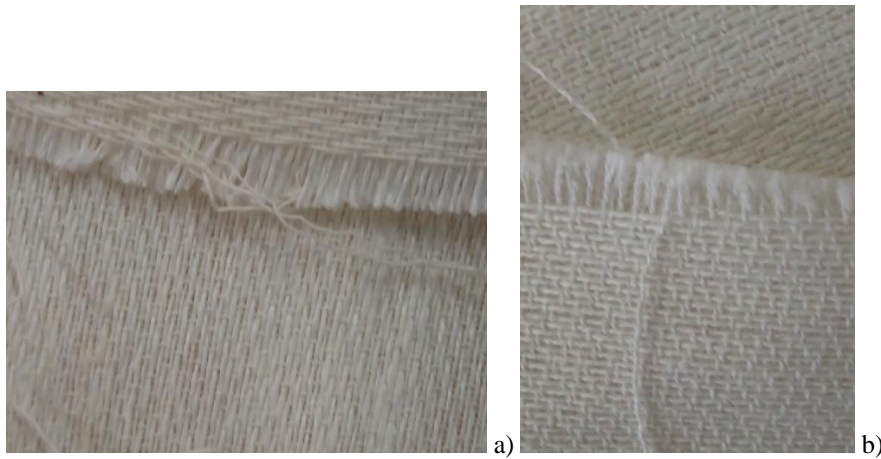


Figure 3. Woven fabrics – semi-doubled weft type: a) the warp is 100% cotton fibers and the wefts are 100% cotton and 100% linen; b) the warp is 98% cotton fibers / 2% regenerated cellulose fibers and the wefts are 100% linen fibers and 98% cotton fibers / 2% regenerated cellulose fibers

These structures are meant to be 2 in 1, namely upper side of the shoe (linen weft) and the lining layer (cotton or cotton/regenerated cellulose type weft).



Figure 4. Woven fabric with 100% linen fibers

### Demonstration and Validation of the Unit for Recycled Vegan Footwear



Figure 5. Shoes designed at ICPI

### Future Activities

- (i) INCDTP makes textile materials woven with yarn from HIFESA and tests these materials in order to verify the characteristics necessary for the production of footwear;
- (ii) ICPI will make a composite based on natural rubber compounded with wood waste. From these mixtures plates will be obtained for the physical-mechanical characterization. The physical-mechanical tests will also be performed on the finished soles made by the partners.
- (iii) ICPI will verify and evaluate the footwear prototypes by wear tests, by questionnaires, by testing the finished product.
- (iv) ICPI will support the project with LCA using its own tools, with data provided by VESICA.

### CONCLUSIONS

Upon completion of the project, the following will be obtained: (a) the complete design of the REWEART system starting with the selection of the basic components of the clothing recycling process; (b) the development of a pilot station for vegan, recycled and organic footwear; (c) implementation of a REWEART platform and ICT tools; (d) recycling of sole materials, mainly rubber for the sole; (e) creating a bio-vegan/recycled footwear model.

### Acknowledgements

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### REFERENCES

\*\*\* [www.life-reweart.eu](http://www.life-reweart.eu)

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