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The future of humanity is shaped by unceasing advances in science, technology, and innovation. In a world driven by the search for the unknown, Altri works diligently to remain at the forefront of transformation, focusing on research and development of ideas and solutions that transcend the boundaries of the present. At the epicenter of this trajectory lies the commitment to sustainable development and an imperative awareness of responsibility for the planet and future generations.

6.1 Innovation




6.1 Innovation

Innovation is a process rooted in the business model of the Altri Group, which promotes the development of scientific and technological projects through multiple partnerships with reference scientific institutions, which allows achieving the objectives they intend to reach. The Altri Group's "investment" in bringing innovation "in an area where there was no knowledge in Portugal" (fiber production) is valued by its stakeholders, who mentioned this aspect during the auscultation process that took place in 2023. It is Altri's active support for scientific research and its incorporation into the organization's processes and business culture that allows the company to innovate on processes and have new products. The Altri Group is positioned at the forefront of excellence innovation and is a recognized partner of its stakeholders, offering focused, lean, and high-added value solutions.

Implementing an innovation strategy is essential for the long-term progress of companies, giving greater competitiveness in the markets, at reduced costs, with efficiency gains, and enabling the creation of products with higher added value. Promoting innovation also positively impacts society and can generate co-benefits through the activity of the Group, as it has been seen in some of the innovations implemented internally that allowed the reduction of water consumption in the process, an increase in energy efficiency with mitigation of emissions and, particularly important for Altri's activity, an increase in forest production


productivity, consequently reducing the need for planting areas. These various changes amplify Altri's performance, guide its investments, and define new areas of research.


Altri's objectives for Innovation are:


-  **Develop new products**
with the internal know-how that allows the Group to develop, produce and market products of higher added value.
-  **Identify and develop innovative processes and technology**
that sustain the efficiency of productive processes and support the production of new products.
-  **State-of-the-art monitoring**
of the technology that may significantly impact the business and development of benchmarks to identify areas for improvement and risks.



In 2023, Biotek, Caima and Celbi were once again honoured with Innovator Status by COTEC Portugal.

-  **Assess new ventures and businesses**
keep up-to-date information on core areas and the ongoing prospecting of new business opportunities within the sector and in adjacent areas.

-  **Develop intellectual capital**
by the consolidation and systematisation of fundamental scientific and technical knowledge, which enables staff training or skill development that ensures long-term sustainability.

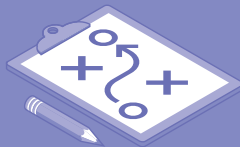
-  **Consolidate R&D activities**
to be the pivot agent for coordination and systematisation of all R&D&I (Research, Development, and Innovation) activities for technological domain of Altri.

6.1 Innovation

Altri's innovation projects have focused particularly on four strategic areas, in areas adjacent to the current business, aimed at creating new products and, whenever possible, based on the Circular Economy. The choice of strategic areas of development takes into account the potential applications of wood and biomass, explored for decades by the cellulosic fiber industry.



Innovation projects include different themes



Cellulose Fibers and New Fibrous Products

Cellulose Chemical Specialties

New Processes and Technologies for Cellulose Fiber Production

Waste recovery and Process Streams



Nevertheless, Altri invests in scientific research for forestry development, a critical success factor, focused on three areas:

- a. **Genetic improvement:** with the selection of *Eucalyptus globulus* for growth, basic density, and wood cellulose content.
- b. **Management of standing and nutrition:** forestry techniques, studying pests and diseases and adjustment of production models.
- c. **Forestry operations:** forestry techniques and systems. As in other areas of the Altri Group, the application of KAI-ZEN principles has improved the processes of the Altri Forestral Research and Development team.

6.1 Innovation

Research & Development Projects (R&D)



Project for the development of new solvents and the dissolution and regeneration of fibers that aims to extend the use of textile fiber raw material of dissolving pulp for stationery.

Supports:



Partnerships:



▾ Status

Completed in April 2023

▾ Contribution to sustainability

Study of alternative fibrous materials (paper pulp) for the production of cellulosic-based textile fibers by implementing new green technologies based on ionic liquids (IL), whose life cycle assessment showed a reduction in the environmental footprint of the textile value chain.

▾ Progress in 2023

- Synthesis of three new non-toxic ionic solvents (IL's) from superbases.
- The joint use of these new IL's with a new pulp pretreatment technique allows the use of the pulp in the production of textile fibers.
- New technologies developed to improve the adsorption of dyes by textile fibers, as well as their resistance to fire.
- The Life Cycle Analysis (LCA) showed that there is a benefit in the integration of pulp and textile fibers production in the same industrial site.

6.1 Innovation



FIBER4FIBER

Project that aims to develop Caima's dissolving pulp for its optimization in the applications of cellulosic-based textile fibers, namely for viscose and lyocell manufacturing processes.

Supports:



Partnerships:



↳ Status

Completed in June 2023

↳ Contribution to sustainability

The Fiber4Fiber project aimed to develop soluble cellulose pulp from Eucalyptus globulus, optimized for the production of cellulosic-based fibers, namely viscose and lyocell, and which can be traceable along the value chain to distinguish products with sustainable origin. The project also included the study of new functionalized lyocell fibers, which can be marketed as value-added products, in the form of textile fibers and technical yarns. This project enabled the internal acquisition of knowledge about cellulosic textile fibers and in particular about lyocell fiber.

↳ Progress in 2023

- Quantification of the impact of soluble pulp properties on textile fiber production and optimization of dissolving pulp for Viscose and lyocell processes. The technical and scientific information obtained was systematized and references were created to be applied in the production of dissolving pulp for application in these textile fibers. This knowledge was extrapolated to the industrial production of dissolving pulp and the resulting industrial pulp was tested in the pilot for validation of the results, thus consolidating the understanding of the impact of the pulp production process on the application of textile fibers.
- Functionalization of the dissolving pulp of Caima to allow its traceability, using chemical markers added in the dissolving pulp process. The analysis confirmed that these markers resist the production process of textile fibers and, therefore, ensure the traceability of dissolving pulp and allow the distinction of products from sustainable origin.
- In the pilot installation, functionalized lyocell fibers were produced to obtain anti-microbial properties, flame retardancy, and anti-static properties, being these fibers intended for the production of technical textiles.

6.1 Innovation



Started in 2022, this project follows the FIBER4FIBER project, which will consolidate the technical infrastructure coming from that project, as well as include eventual upgrades in the pilot and acquisition of new analytical equipment.

Supports:



Partnerships:



Collaborative project with the participation of Altri Caima in Pillar I (biomaterial) Initiative 1 – Regenerated Cellulose Fibers. Consortium led by CITEVE – Technological Center of the Textile and Clothing Industries of Portugal.

↳ Status

Ongoing until 2025.

↳ Contribution to sustainability

Development and training of knowledge, and physical and human infrastructure in the area of regenerated cellulose fibers and non-woven fabrics (TNTs). Add value from renewable resources and develop alternatives to fossil-based materials.

↳ Progress in 2023

Regenerated Cellulose Fibers:

- Technical specifications and technological surveillance studies were carried out, which will serve as a basis for R&D in modern processes of dissolving cellulose with different solvents and spinning by wet spinning, including the production of lyocell fibers.
- Optimization of the production of lyocell fibers at pilot scale with studies of additive/functionalization of the fibers and validation regarding their quality and chemical and mechanical performance.
- Study of the effect of the properties of Caima dissolving pulp on the quality of the dope (dissolved fiber solution) and lyocell fibers.
- Evaluation of R&D infrastructure with the ability to produce lyocell cut fibers (staple fiber) in sufficient quantity and quality to enable the production of diverse samples, from yarns to staples, fabrics, and non-fabrics.

6.1 Innovation



B2-SOLUTIONS

Bioplastics development project for application in flexible paper-coating and bio-composite plastics for application in semi-rigid and rigid plastics in the production of injection molding components for the automotive industry and other industries.

Supports:



Partnerships:



↳ Status

Completed in June 2023

↳ Contribution to sustainability

With this project of application of cellulosic fibers as biodegradable bioplastic additive (B2), a technological design process was started to allow the incorporation of cellulosic fibers in the form of pulp or by-products of the pulp manufacturing process, in flexible plastics (films) and especially in semi-rigid and rigid plastics that are used in the automotive industry.

↳ Progress in 2023

- Synthesis of composite formulations of polymeric matrix reinforced with graphene.
- Synthesis of composite formulations for flexible plastics incorporating colophony resins.
- Composite formulations of polymeric matrix for semi-rigid plastics, reinforced with fibers of plant origin from the pulp industry. One of the formulated biocomposites, known as B116-V2, was industrially tested in a manufacturer of automotive parts and showed a compressive strength higher than to the polypropylene which is normally used.
- A life cycle analysis was performed to evaluate the environmental sustainability of the new formulations of bioplastics and biocomposites developed in the project. The evaluated products included two formulations for use in the automotive industry, one of which was B116-V2, and two flexible formulations for paper coating.
- Based on the life cycle assessment and technical performance, two formulations were also subjected to tests of recyclability, biodegradability, and compostability, carried out in certified external laboratories, and that led to requests for “Product Certification” (approval expected only in 2024).

6.1 Innovation

HIGH2RPAPER

Project for the development of a new recycled paper incorporating raw pulp from waste from the eucalyptus bleached pulp industry, based on the principles of the circular economy, giving rise to products of higher added value.

Supports:



Partnerships:



↳ Status

Completed in June 2023.

↳ Contribution to sustainability

Project for the development of a new high-resistance recycled paper incorporating raw pulp from waste from the eucalyptus bleached pulp industry, based on the principles of the circular economy, giving rise to products of higher added value.

Baking waste is a waste from the currently unused paper pulp industry. The project has developed industrial processes that can transform this waste into a pulp for paper. In addition to the production of this new waste pulp, the project intended to develop processes so that this pulp can be added to the recycled paper pulp to improve its properties and finally those of the recycled paper.

↳ Progress in 2023

- Start of the preparation of materials, on a test scale, but in an industrial context that allows the production of raw materials for the production of prototypes in the Papeleira Coreboard.
- Prototype tests were performed on an industrial scale, aiming to make necessary adjustments and adaptations in the manufacturing process.
- In the final phase of the project, results were promoted and disseminated through technical and scientific articles and workshops, as well as in the participation in scientific congresses and international fairs.

6.1 Innovation

ACETIC ACID AND FURFURAL IN CAIMA

This R&D project is supported by the knowledge generated in the CaimaChem R&D project and intends to study the industrial viability of recovering acetic and furfural acid, present in evaporation condensates.

Supports:



Partnerships:



↳ Status

Research project completed in December 2023.

↳ Contribution to Sustainability

The removal of acetic acid and furfural allows to:

- Recover these compounds and minimize the impact on the effluent;
- Increase Caima's turnover by adding value to its process without impact on wood consumption;
- Transform a sub-chain into a product, leading to a decrease in the organic load of condensate for treatment of effluent, with a reduction in the inherent costs;
- Produce two renewable-based products, based on a concept of circular economy, which will add economic, environmental and social value to Caima;
- Create synergy with the biomass boiler, which will produce the renewable base steam needed for the acetic acid and furfural separation unit.

These projects are under development with the aim of recovering these two compounds that will be consumed as raw materials from various chemical industries, thus enabling environmentally sustainable recovery.

↳ Progress in 2023

After completion of the R&D cycle, in the end of the year, the procedures for a new phase of industrial innovation of the project began.

6.2 Future perspectives

6.2 Future perspectives

The year of 2023 was a year of adjustment in the global pulp market cycle, with China returning to a positive post-Covid dynamic and Europe and North America returning to a structurally downward trend in demand for the P&W end-use segment and sustained growth in Tissue. The global market interrupted the downward cycle towards the summer due to China's strength, which eventually led to an improvement in price levels in Europe as well, after reaching lows in August. This improvement in both demand and prices continued during 4Q23 and we continue to see the same positive trends at the start of 2024.

After a year 2023 with a particularly strong Chinese market in terms of demand (+28.5% - source: PPPC), we continue to have indications that the Chinese market will maintain a good dynamic in 1Q24. In the European market, the destocking effect tended towards the end of 3Q23 and since then we have begun to feel a recovery in the most affected segments and normalization of papermakers' stock levels, especially in the P&W segment. As such, we anticipate that Europe could have a first half of 2024 with a recovery in demand and some sustained improvement in prices.

The Altri Group achieved a very significant decrease in costs during the year 2023, achieving a consecutive reduction of the cash-cost/ton in four quarters. We believe that variable costs will stabilize during 2024 and are unli-

kely to follow the downward trend of recent quarters. The Altri Group will continue to work to maintain a sustained cost level that is appropriate for solid profitability.

In what concerns the Gama project, in Galicia, the Altri Group reiterates its intention to take a final investment decision as soon as the necessary conditions are met. To be noted that the Gama project stems from a Memorandum of Understanding (MoU) signed with Impulsa, a public-private consortium from the Autonomous Community of Galicia to study exclusively the construction of a greenfield industrial plant from scratch, to produce soluble pulp and sustainable textile fibers.

The Altri Group has been significantly investing in various diversification projects in the various production units, in addition to Gama, of which we highlight the recovery and valorization of acetic acid and furfural from renewable sources in Caima, scheduled for completion in 2025.

In terms of pulp mill's maintenance downtime scheduled in 2024, the schedule is as follows:

- Celbi: May 2024
- Biotek: March 2025
- Caima: March 2024

We refer to the considerations disclosed in Note 45. Subsequent Events in the notes to the consolidated financial statements.

