Sinergie SIMA
Management Conference

# Rediscovering local roots and interactions in management

## *Conference Proceedings*

## *Long Papers*

*Bari (Italy)*

**29-30 June 2023**

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## *Conference Proceedings*

Long Papers

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*Arabella Mocciaro Li Destri, Marta Ugolini,*
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To the reader,

this volume contains the long papers of the Sinergie-SIMA 2023 Management Conference, hosted by the LUM University and University of Bari at Mercure Villa Romanazzi Carducci (Bari) on June 29th and 30th 2023.

Theory and practice in the field of management have been challenged by the emergence of deep transitions such as those driven by globalization, the rise of social and environmental issues, and the diffusion of digital technologies. Events such as the ensuing geopolitical crises and the pandemic further contribute to spur management scholars to feel the call to produce impactful research with theoretical and managerial implications on the relationship between location and strategy (Bathelt and Li, 2022).
As a consequence, scholars and practitioners have been asked to design new business models and rethink value chains in a twofold direction (Mazutis et al., 2021). First, the relevance of local roots sheds light on the way people create and shape places, as much as places shape people and their organizations, suggesting a need to rethink how all lives 'take place' in places, as well as how all business happens in paces (Sternad et al., 2017). Second, a need for new interactions emerges, suggesting that businesses are deeply connected to their roots, that are their homes, from which they draw inspiration, identity, and sources of competitive advantage (Soderstrom and Weber, 2020).
Rediscovering local roots and specific assets, as well as developing new ways of interaction among the economic actors and their stakeholders, can help firms to design effective and innovative strategies to create and share values (Mair et al., 2016), with positive economic, social, and environmental impacts (Attig and Brockman, 2017).
Several research questions stimulate an interdisciplinary debate in the field of management. These questions relate to the ability of firms and managers to move, among the others, between global and local relations, near/physical and far/digital interactions, reshoring and offshoring activities, omnichannel competition and retail interactions, market transactions and system operating structures, traditional and innovative approaches, social/local benefits and financial/global performances, business ethics and ethics in business.
In the same way, different theories, methodological approaches, and units of analysis are required to generate scientific research that has an impact not only in terms of theoretical contribution but also on the real business world.

The Sinergie-SIMA 2023 Management Conference was a great occasion to discuss about the research efforts of our research community on thematic tracks related to the Conference theme (the function of territorial or cultural roots and of operational interactions in management) and the SIMA thematic groups (Entrepreneurship, Innovation & technology management, International business, Marketing, Retailing & Service management, Small & family business, Strategic communication, Strategy & Governance, Supply chain management, logistics & operations, Sustainability, and Tourism and culture management).

The Conference call for papers gave the opportunity to submit either short or long papers. Overall, the editorial staff received 215 short papers and 63 long papers.

For the *short and long papers*, the evaluation followed the peer review process, with a double-blind review performed by two referees - university lecturers, expert about the topic - selected among SIMA and the community of Sinergie members.

In detail, the referees applied the following criteria to evaluate the submissions:
- clarity of the research aims,
- accuracy of the methodological approach,
- contribution in terms of originality/innovativeness,

- theoretical and practical contribution,
- clarity of communication,
- significance of the bibliographical basis.

The *peer review* process resulted in full acceptance or rejection of the submissions. In the case of disagreement among reviewers' evaluations, the decision was taken by the Chairs of the SIMA thematic groups or conference track. Each work was then sent back to the Authors together with the referees' reports. The suggestions received by the referees were used by the Authors during the presentation of their research works at the Conference.

The evaluation process ended with the acceptance of 215 short papers and 62 long papers, which were published in two distinct volumes.

All the long papers published in this volume were presented and discussed during the Conference and published online on the web portal of Sinergie-SIMA Management Conference (**https://www.sijmsima.it/**).

While thanking all the Authors, Chairs and participants, we hope that this volume will contribute to advance knowledge about the rediscovering local roots and interactions in management.

The Conference Chairs

*Angelantonio Russo, Savino Santovito, Arabella Mocciaro Li Destri and Marta Ugolini*

# SUMMARY

# Packaging, logistics and sustainability. Exploring innovative solutions for eco-sustainable packaging

ALESSANDRA COZZOLINO*

## Abstract

**Framing of the research:** *The sustainability challenges posed by packaging value chains require urgent actions inside the international and national sustainable product policy framework and industrial strategy.*

**Purpose of the paper:** *The paper aims at exploring innovative solutions for eco-sustainable packaging considering the implications on logistics optimization with a specific focus on the potentiality of paper materials.*

**Methodology***: After a literature review, an empirical exploration is run to briefly describe 123 successful cases of packaging innovations towards sustainability.*

**Results***: Packaging can concretely contribute to achieving the business's sustainable development goals along the supply chain. The preliminary considerations underline that there are many concrete solutions for sustainable packaging, and that there are good results in terms of LCA analysis.*

**Research limitations:** *The empirical analysis can be extended.*

**Managerial implications:** *As eco-packaging emerges as a key trend in the market this research presents real case applications that propose a comprehensive map for managers and practitioners who wish to experience similar projects.*

**Originality of the paper:** *Logistics assumes a key role for sustainable packaging innovation in theory and in practice; that may be of particular interest to both academics and professionals in different sectors and with different roles along the entire supply chain.*

**Key words:** *Packaging; Logistics; Sustainability; Innovation; Supply chain; Paper and cardboard.*

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## 1. Introduction

Recent research reports cited in Forbes (2022[1]) underline how eco-packaging emerges as a key trend in the market. A first study estimates that the global recyclable packaging market will reach 28.3 billion dollars in value with a growth rate of +7.2% compared to 2021 and will reach 34.2 billion dollars in 2026. Another study describes that 77% of consumers want to have as less packaging as possible and 63% would consider changing their shopping habits if this criterion were not met. That is a global trend that is also influencing the market in Italy where in just one year the products that explicitly communicate on the label how to handle the packaging after consumption have grown by 5% and 35.9% of the total of large-scale distribution (Forbes, 2022). In fact, the environmentally sustainable impact of packaging has been in the last years an increasingly important issue for businesses (Svanes *et al.*, 2010; Lewis *et al.*, 2007; Verghese and Lewis, 2007; Hellstrom and Nilssonon, 2011; Boz *et al.*, 2020; Nguyen *et al.*, 2020; Cozzolino and De Giovanni, 2023). Min and Galle (2001) stress that when there is a demand for green purchasing, it affects packaging, which in turn affects logistics. Many authors have emphasised the close relationship between the concepts of packaging and logistics which focuses on the synergies achieved by integrating packaging and logistics with the potential of increased supply chain efficiency and effectiveness (Garcia-Arca *et al.*, 2014; Azzi *et al.*, 2012 p. 441; García-Arca and Prado-Prado, 2008; Hellström and Saghir , 2007; Verghese and Lewis, 2007; Saghir, 2002; Lockamy, 1995; Twede, 1992). It is precisely the packaging logistics processes that make product packaging possible, flowing through the entire supply chain and defining interaction with the physical environment and the socio-economic context (Cozzolino, 2021; Vernuccio *et al.*, 2010). Furthermore, packaging influences product development and design, and production (Zhu *et al.*, 2022). The debate on the impact of packaging on the natural environment has more recently shifted towards a more holistic discussion of the impact of the packaging life cycle throughout the supply chain (Sarkis, 2003).

Along this direction, there is no one-size-fits-all solution that innovators in this field can embrace as they work on strategies for sustainable logistics packaging. According to Berg *et al.* (2020), there are complexities and trade-offs to consider if they are to navigate through these sustainability challenges in order to find the most effective route to growing and preserving value with application innovations, driving toward sustainability in packaging, but beyond the "quick wins". This could be done clearly benchmark packaging alternatives in terms of sustainability, cost and convenience; fully understanding sustainability requirements; having the right partnerships for innovation and technology to respond to consumer and customer packaging demands going forward. In a general view, sustainable packaging compared to conventional packaging, meet higher environmental, economic and social standards, have better performance and quality features, and at the same time bring new possibilities in the field of the recovery and waste management. These standards should apply to the entire packaging life cycle - from production, through packaging, distribution, transport processes, to use and disposal (Kozik, 2020).

In a circular economy perspective, the packaging plays an important role due to its pervasiveness along supply chains, both as a product itself and as a combination of product-packaging (Cozzolino, 2022), and both in forward and reverse logistics flows, considering the principles of reduce, reuse, and recycle (Cozzolino and De Giovanni, 2023). The European Commission, in the "*Circular economy action plan. For a cleaner and more competitive Europe*" document, considers packaging among the "key product value chains" with a high potential for circularity[2]. Accordingly, the sustainability challenges posed by packaging value chains require urgent, comprehensive, and coordinated actions that form an integral part of the European sustainable product policy framework and industrial strategy, contributing to the response to climate emergencies, and focusing on reducing (over)packaging and packaging waste, driving design for re-use and recyclability of packaging, and considering reducing the complexity of packaging materials.

[1] https://forbes.it/2022/10/13/packaging-riciclabile-numeri-trend-mercato-forte-crescita/
[2] https://ec.europa.eu/environment/pdf/circular-economy/new_circular_economy_action_plan.pdf

Along these directions, previous studies mainly focused on single case studies which consider very specific aspects of sustainable packaging linked to circular practices, with the exception of the recent work by Cozzolino and De Giovanni (2023). Therefore, very few are the studies explicitly considering the implications on packaging logistics optimization (Cozzolino, 2021). Furthermore, there has been limited analysis with a focus on paper and cardboard potentiality as a valid substitute of plastic packaging very often (Silva and Molina-Besch, 2023). Following the studies conducted by Cozzolino and De Giovanni (2023) and Cozzolino (2021), the paper aims at investigating the following research question (RQ):

*RQ1 - Which innovative solutions for eco-sustainable packaging in paper and cardboard material do firms adopt?*

The proposed RQ seeks to fill research gaps that have emerged from an analysis of the scientific literature. Therefore, this study brings together the identification of multiple concrete successful sustainable innovations for packaging design, considering the implications on packaging logistics optimization (for example, allowing to load a greater number of packages per pallet or by means of transport, and / or improving stackability, etc.), and with a specific focus on the potentiality of paper materials. To pursue the objectives of this study, data available through the National Consortium of Packaging (CONAI) in Italy were used. The CONAI presents a consultable showcase of the range of virtuous packaging materials on the Italian market in the last years that it has been analysed in this paper.

The remainder of the paper is organized as follows: section 2 outlines the theoretical background and identifies the research gaps; section 3 describes the research methodology; section 4 presents an analysis and discussion of the findings; section 5 concludes.

## 2. Literature review

The way circular economy systems truly work for firms around the world is at the beginning of knowledge development. As such, it is useful for academia and practitioners to provide an analysis of how to concretely implement and manage innovative projects to shift from a linear to circular supply chain management. Following a chronological order (from the latest back), some more recent studies from the academic literature that focus on concrete sustainable practices implemented for the circularity of packaging in paper and cardboard are synthetically described so to list the elements that most are original in the present work compared with previous research.

The study by Cozzolino and De Giovanni (2023) analyzed portfolios of sustainable practices adopted by Italian firms to enhance the circularity of packaging and related results in terms of life cycle assessment, with environmental improvements, such as reductions of CO2 emissions as well as energy usage and water consumption, considering a large number of circular packaging projects along the last 10 years. A granular analysis of the impact of the material reveals that the specific type of packaging material (especially with a focus on paper and plastic) can change firms' preferences regarding sustainable practices they want to adopt.

Silva & Molina-Besch (2023) assessed the environmental impacts of plastic cushioning inserts vs. corrugated cardboard cushioning inserts. The cushioning options have different measurements requiring different box sizes. The results reinforce the importance of developing alternatives to plastic packaging without increasing packaging weight. Belonging to the same research stream, they cited other research on the comparison of the environmental impacts of different packaging options, as reported in the following lines. Albrecht *et al.* (2013) studied a case in Europe where disposable cardboard boxes are compared with reusable plastic crates. The study concludes that the reusable plastic option leads to lower environmental impacts and lower costs, with the assumption that about 80% of the cardboard is incinerated with energy recovery and the remaining about 20% is recycled. Abejón *et al.* (2020) presented the opposite assumption: 80% of cardboard packaging waste is recycled and 20% is incinerated with energy recovery. The Global Warming Potential-GWP of disposable cardboard boxes is around 10 times higher than the GWP of the reusable plastic crates.

Accorsi *et al.* (2022) included disposable plastic packaging in the analysis, and their results show that disposable plastic packaging represents the highest GWP (20 years) of the three options. Moreover, after 15 uses, reusable plastic crates lead to a lower GWP than disposable cardboard boxes. Another similar case study is by Koskela *et al.* (2014): they found that one-way cardboard boxes lead to lower emissions due to the impact of extra weight in reusable plastic solutions. Similarly, Lo-Iacono-Ferreira *et al.* (2021) in their research discovered that one-way cardboard boxes produce lower emissions. Sasaki *et al.* (2022) highlighted the importance of considering protection levels when comparing packaging alternatives. They conclude that reusable plastic packaging and one-way cardboard boxes had similar environmental performances, but the former leads to higher food loss. This aspect of protection is vital for any product that can be damaged during transport and handling.

Coelho *et al.* (2020) reviewed the trends in reusable packaging and the literature on reusable packaging to generate insights into the current state-of-the-art knowledge and identify directions for research and development. This can help to better understand the key factors underlying the design and impacts of more sustainable packaging systems. New research includes the need to monitor the effectiveness and efficiency of current systems and new opportunities in packaging; along this way design may also play an important role for packaging systems.

Ferrara and De Feo (2020) applied the life cycle assessment methodology to compare the environmental performance of the traditional single-use glass bottle for wine with four packaging alternatives (aseptic carton, bag-in-box, refillable glass bottle and multilayer PET bottle) for the Italian market. This study highlighted the importance of considering the wine packaging as a system, i.e. including also the production and use of secondary and tertiary packaging. They pointed out that the good recyclability of a material generates great confusion in the common imaginary: people confuse the recyclability of a material with its sustainability, completely neglecting the impacts associated with the production and transport of the material.

Burek *et al.* (2018) evaluated various packaging solutions generally used in the milk industry and developed comparisons according to an LCA. Their analysis demonstrated that the adoption of lightweight and fully recycled containers can considerably improve environmental impacts. The U.S. packaging market needs to increase milk packaging variety based on precompetitive collaboration and sharing knowledge on improving all segments of fluid milk and container production and delivery; the success of the new packaging depends on assessing the system as a whole.

Geueke *et al.* (2018) provided an overview of the most important properties of food packaging materials affecting their recyclability, as recycling is fundamentally relevant to achieving a circular economy. In addition, recycling practices are exemplified for the different materials, along with decontamination options for removing chemicals of concern. Finally, criteria for successful reduction, reuse, and recycling are discussed with regard to permanent and non-permanent packaging materials. Among those identified as most common types of food packaging materials they explicitly consider paper and board. As indicated in Geueke *et al.* (2018), citing Lofthouse *et al.* (2017), packaging redesign can significantly contribute to reduction, reuse, or recycling, if the end of life is already considered during packaging development.

Saraiva *et al.* (2016) developed a study on a packaging dedicated to transportation of Brazilian mango fruits from producer to end-consumer aiming at reducing food losses in the food supply chain. A life cycle assessment was used to compare the environmental performance of a reusable frame, made from high density polyethylene reinforced with natural sponge fiber residue, and a high impact polystyrene recyclable tray, with those of an identical packaging produced without natural fibers and a commercial cardboard packaging. The paper contributed in the literature on transport and packaging that can result in a substantial contribution to the overall environmental impact of the fruit supply chain.

Dominic *et al.* (2015) studied a corrugated box for a specific firm product and found opportunities in the technical design, supply chain implementation and environmental impact of this packaging, in terms of optimization of product protection, waste and CO2 emissions. They

proposed that future research with respect to an integrated packaging design model should factor a greater understanding of waste/product loss across the supply chain, and the recycling/reusability of the material, leading to a higher percentage of secondary content in produced materials.

Previous research is mainly focused on trying to clarify the environmental implications between returnable plastics and one-way cardboard transport packaging, as the literature diverges in the comparison of the environmental impacts of these two options (Albrecht *et al.*, 2013; Koskela *et al.*, 2014; Abejón *et al.*, 2020; Lo-Iacono-Ferreira *et al.*, 2021; Accorsi *et al.*, 2022; Sasaki *et al.*, 2022; Silva and Molina-Besch, 2023), and does not pay much attention to the potential of more cases options. In fact, while the analyzed studies mainly focused on either a single case or product in a specific sector, this research seeks to develop more generalizable findings, as also Cozzolino and De Giovanni (2023) did. Moreover, even if the general literature has emphasized the close relationship between the concepts of packaging and logistics and their synergies and potential of increased supply chain efficiency and effectiveness toward sustainability, not so much are the empirical investigations on logistics implications in the face of reduce, reuse and recycle practices. Coelho *et al.* (2020) indicated among key factors that affect the economics and environmental impact of packaging reuse logistics (both organization and transport distance). Raw material saving and logistics optimization emerged from Cozzolino and De Giovanni (2023) as the most frequent sustainable practices adopted by firms to improve circularity of packaging. Furthermore, most of the literature has focused on the adoption of single sustainable practices to improve the sustainability of packaging; when a portfolio of sustainable practices was studied, it was limited to two sustainable practices, for example, Ferrara and De Feo (2020) and Saraiva *et al.* (2016); in contrast, Cozzolino and De Giovanni (2023) considered simultaneously the three. Following these gaps, the present paper investigates the most frequently adopted sustainable practices for packaging in paper and cardboard, with logistics optimization implications, inside a variety of different cases from different economic sectors.

## 3. Methodology

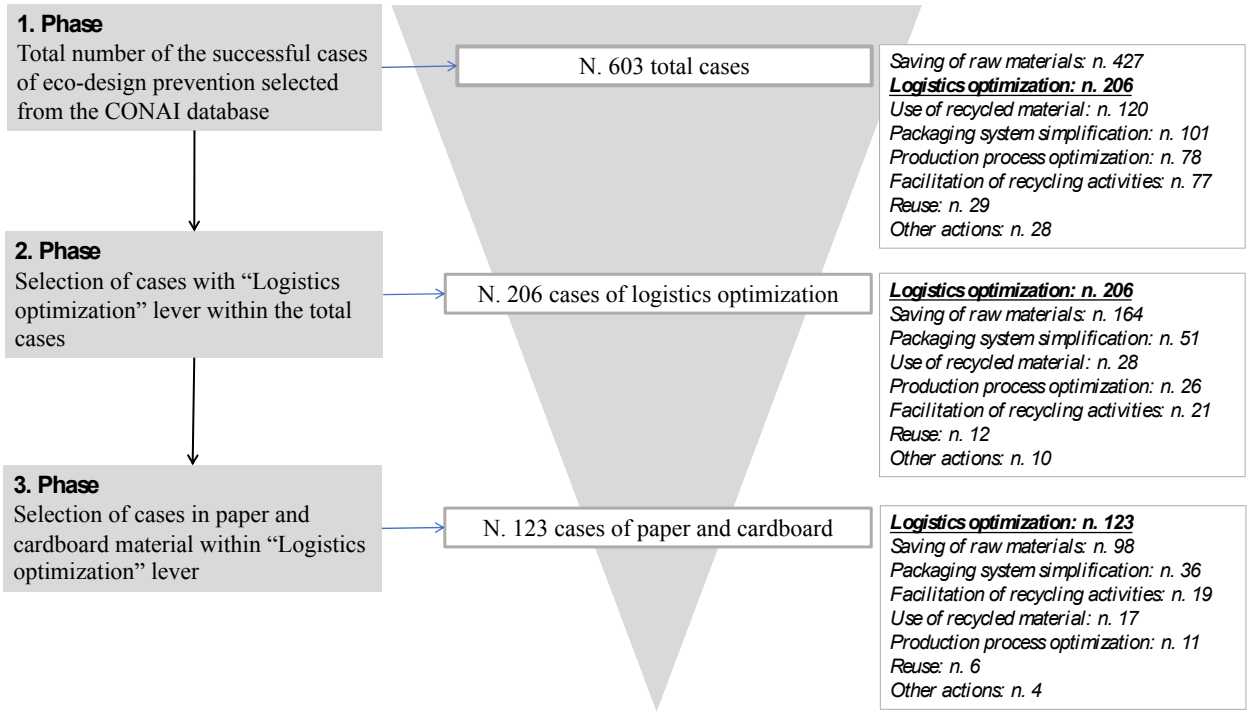
Cases are selected from the CONAI database entitled “Successful cases” of eco-design prevention. The CONAI’s purpose aims to raise awareness on prevention topic for all the supply chain, from producer to consumer, to realize the transaction toward both circular economy criteria and sustainable development goals. Prevention for CONAI is a set of policies, programs and best practices, taken before a substance, material or product has become waste. In reference to packaging solutions, one of the most important challenges is to minimize environmental impacts with a life cycle approach. Following this direction, the CONAI presents a consultable database of the range of virtuous packaging materials on the Italian market in the last years[3].

From a total numbers of cases of 603, referring to all the categories (liquid food, solid food, personal care, domestic detergent, container ideas, ideas for abroad, other areas), the last 10 years and all the mapped levers (logistics optimization, facilitation of recycling activities, raw materials saving, optimization of production processes, reuse, simplification of the packaging system, use of recycled material, other), 123 cases have been obtained in the respect of the two criteria of selection (see Figure 1):

- logistics optimization lever;
- paper and cardboard material (alone, and also in combination with plastic, glass and wood).

[3] www.conai.org

*Fig. 1: Sample selection process.*




Source: author elaboration.

To answer RQ, the most frequent sustainable practices adopted by firms to increase the sustainability of paper/cardboard packaging, considering the optimization of logistics, are mapped. Also, the possible combinations of sustainable practices are described. Moreover, the main results of the LCA (Life Cycle Analysis) are reported. These is useful to derive state-of-the-art innovative practices analyzed.

## 4. Empirical results and discussions

The cases analyzed are composed of paper and cardboard packaging, among those 83 are only in paper or cardboard material, while 36 are paper and plastic, 3 in paper and glass, and 1 in paper, plastic and wood (see Table 1).

*Tab. 1: Materials.*

| *Material* | *Cases* |
|---|---|
| *Paper* | *83* |
| *Paper and plastic* | *36* |
| *Paper and glass* | *3* |
| *Paper, plastic and wood* | *1* |
| *Total* | *123* |

Among the adopted practices, within the cases of logistics optimization, saving of raw materials was found the most frequent in 80% of the cases of packaging, following by packaging system simplification (29%), facilitation of recycling activities (15%), use of recycled material (14%), production process optimization (9%) and reuse (5%), as shown in Table 2.

*Tab. 2: Levers.*

| *Lever* | *Logistics optimization (LO)* | *Saving of raw materials (SRM)* | *Packaging system simplification (PSS)* | *Facilitation of recycling activities (FRA)* | *Use of recycled material (URM)* | *Production process optimization (PPO)* | *Reuse (R)* | *Other actions (OA)* |
|---|---|---|---|---|---|---|---|---|
| *Number of cases* | *123* | *98* | *36* | *19* | *17* | *11* | *6* | *4* |
| *%* | *100%* | *80%* | *29%* | *15%* | *14%* | *9%* | *5%* | *3%* |

Together with the optimization of logistics, that only in 10 times is alone in the innovative projects of packaging, other practices are implemented in combination (see Table 3). The most frequent combinations are between 2 or among three levers: they are mainly logistics optimization and saving of raw materials, and also packaging system simplification. Few cases are in combination with 4 or 5 lever simultaneously. The 4-lever combination is among logistics optimization, saving of raw materials, facilitation of recycling activities, and (equal) packaging system simplification or use of recycled material. The combination with 5 levers is characterized by logistics optimization, (equal) saving of raw materials or packaging system simplification or use of recycled material, following by facilitation of recycling activities and production process optimization.

*Tab. 3: Combinations.*

| *Numbers of levers per case* | *Frequency* | *Most frequent combination* |
|---|---|---|
| *1* | *10* | *Logistics optimization (10)* |
| *2* | *57* | *Logistics optimization (57) & Saving of raw materials (48)* |
| *3* | *37* | *Logistics optimization (37), Saving of raw materials (32) & Packaging system simplification (22)* |
| *4* | *16* | *Logistics optimization (16), Saving of raw materials (15), Facilitation of recycling activities (10) & Packaging system simplification/Use of recycled material (9)* |
| *5* | *3* | *Logistics optimization (3), Saving of raw materials/Packaging system simplification/Use of recycled material (3), Facilitation of recycling activities (2) & Production process optimization (1)* |

The 19 cases that present the major combination of practices (16 with 4 levers, and 3 with 4 levers) are reported in Table 4, with their qualitative description.

*Tab. 4: Cases with major combinations.*

| *Firm* | *Case description* | *LO* | *FRA* | *PPO* | *SRM* | *R* | *PSS* | *URM* | *OA* |
|---|---|---|---|---|---|---|---|---|---|
| *Scatolificio Porrettana S.r.l.* | *The new packaging solution designed by Scatolificio Porrettana Srl is perfectly suited to four types of engines and has better environmental performance compared to the previous solution. The packaging, initially made up of a corrugated cardboard component and EPS components, was replaced with a new mono-material packaging system, 9% lighter, entirely composed of corrugated cardboard, allowing recycling activities to be facilitated.* ***The new packaging has also allowed for a 100% optimization of logistics.*** | *1* | *1* | *0* | *1* | *0* | *1* | *0* | *0* |
| *HP Italy S.r.l.* | *In 2019, HP redesigned toner cartridge packaging for color printers to improve recyclability and optimize the use of raw materials. The weight of the cardboard box has been reduced by 36%, the HDPE side protections have been replaced by 100% recycled paper elements, thus preferring a single-material solution,* ***and the quantity of units per pallet has increased by 43%. thanks to the reduction in the size of the box.*** | *1* | *1* | *0* | *1* | *0* | *0* | *1* | *0* |
| *Cartotecnica Jolly Pack S.r.l.* | *The intervention carried out concerns the redesign of the display containing balsam cardboard cases initially consisting of a base, a lid and a corrugated cardboard* | *1* | *0* | *1* | *1* | *0* | *1* | *0* | *0* |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *crowner. The new solution consists of a single cardboard element that can hold 18 balm cases, instead of 12. In addition to this simplification, the weight of the balm case has been reduced by 31%. Overall,* ***the intervention makes it possible to transport 20% more product on the pallet*** *and to reduce process waste, thanks to the optimization of the die-cutting yield of the display (2 pieces instead of 1 on sheet) and of the cartons (24 pieces instead of 16 on sheet).* | | | | | | | | |
| *Hipac S.p.a.* | *Hipac has created a new and innovative technical stretch film in LLDPE, intended for the packaging of industrial products, which combines a reduced thickness of 48%, compared to the film normally used for the same purpose, with the use of 67% recycled material. The reduction in thickness has allowed savings in raw material,* ***optimization of logistics****,* ***thanks to the increase in the number of reels transported on the pallet****, and a reduction in energy consumption during the production process (-35%). Furthermore, the cardboard core on which the film was wrapped has been eliminated, simplifying the system.* | *1* | *0* | *1* | *1* | *0* | *1* | *1* | *0* |
| *Duracell Italy S.r.l.* | *The company has changed the primary packaging of the 6 AAA batteries of the Plus line and the Ultra line, initially consisting of a blister with a cardboard base and PET shell. The new, simplified solution provides for a single cardboard box with a higher percentage of secondary raw material. The transition to mono-material packaging has led to an improvement in the recyclability of the same packaging.* ***Furthermore, the new case, reduced in size, also had a positive effect on logistics.*** | *1* | *1* | *0* | *0* | *0* | *1* | *1* | *0* |
| *Scia Packaging S.r.l.* | *The packaging for containing glass bottles, initially consisting of a box and corrugated cardboard separators, has been replaced by a single box with incorporated separators. This solution allows the creation of the packaging in a single die-cut, with a single printing and die-cutting stroke, as the dividers are obtained from the body of the main packaging with consequent energy savings (about -9%). Furthermore, the new structure guarantees the same resistance to stacking by using a corrugated cardboard with a single wave instead of a double one. The weight of the packaging was reduced by around 45% and* ***the number of products transported on the pallet increased by 42%.*** | *1* | *0* | *1* | *1* | *0* | *1* | *0* | *0* |
| *Litocartotecnica Valsabbina S.r.l.* | *The packaging for the door handles has been redesigned allowing for a 25% reduction in the cardboard box, the elimination of the LDPE protective component and* ***a greater product load on the pallet.*** *The intervention also had positive effects on the production process as the new box design allowed for a 77% reduction in production waste.* | *1* | *0* | *1* | *1* | *0* | *1* | *0* | *0* |
| *Gias S.r.l.* | *Gias Srl, a Candy Hoover Group company, has revised the packaging intended for the containment and transport of refrigerator gaskets. The new primary packaging in corrugated cardboard has been reinforced allowing the elimination of the external cardboard box and the plastic protection and closure elements. The intervention has favored the reduction of over 60% of raw material and* ***an increase of 500% in units transported.*** | *1* | *1* | *0* | *1* | *0* | *1* | *0* | *0* |
| *4P SRL* | *4P SRL manufactures and sells palmtop computers for professional applications all over the world. In 2015 it renewed the packaging system of the FDA600 handheld computer with a view to greater environmental sustainability. The packaging system, initially made up of a paper and a plastic component, has been made mono-material and more easily recyclable. The outer component also contains a higher percentage of* | *1* | *1* | *0* | *1* | *0* | *0* | *1* | *0* |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *recycled material than the previous packaging. Furthermore, the redesign of the packaging has favored a reduction in both weight and volume,* ***optimizing logistics operations with a 148% increase in primary packaging transported on standard pallets.*** | | | | | | | | |
| *Vimar S.p.a.* | *The packaging of the power strip with cable has been redesigned from a solution that included a PVC film/film, a cardboard sheet and a PVC shell to a solution consisting of an HDPE bag and a cardboard label. This intervention has allowed the elimination of the film/film, the reduction in weight of the plastic packaging (-87%) and* ***the optimization of logistics****. In addition, the company uses a product transport box whose percentage of recycled material used for the production of the same has increased from 30 to 70.* | *1* | *1* | *0* | *1* | *0* | *1* | *1* | *0* |
| *BB Line S.r.l.* | *BB line Srl, which produces accessories and solutions for decorating windows, launched the EcoPack project a few years ago with the use of low environmental impact packaging. In 2014, the project was further extended to other products whose previous packaging, made up of a sheet of cardboard containing 95% recycled paper and a PVC shell, was replaced by a cardboard made from 100% recycled paper and a thin polyurethane strap that fixes the product to the cardboard. Overall, the intervention has made it possible to increase the company's environmental performance.* | *1* | *1* | *0* | *1* | *0* | *0* | *1* | *0* |
| *Big Paper Italia S.r.l.* | *The solution before the intervention, made up of a laminated paper-HDPE sheet on which the food rests, an HDPE sheet that protects the food and a paper bag that encloses everything, has been replaced by Big Paper from a single component coupled with 100% recycled paper and mater-bi film. This intervention has allowed an overall weight reduction of 62% and* ***positive effects in terms of logistics****, also thanks to the introduction of side flaps which allow the entire available surface to be used.* | *1* | *1* | *0* | *1* | *0* | *1* | *1* | *0* |
| *Elica S.p.a.* | *The packaging for Elica SpA extractor hoods has been modified according to the "less air to transport" approach. The packaging, which was made up of a corrugated cardboard box, a low density polyethylene film and polystyrene protectors, now consists of a corrugated cardboard box whose weight has been reduced by over 20% for the same of performance, from the LDPE film and from the PP strap, and* ***allows an increase in the transportability value of 36%.*** *Since 1999, the company has had an Environmental Management System compliant with the UNI EN ISO 14001 standard.* | *1* | *0* | *0* | *1* | *0* | *1* | *0* | *1* |
| *Gianasso S.r.l.* | *Saponificio Gianasso has redesigned the packaging of the 400 ml scented almond oil shower gel - Green tea from the I Provenzali line. The new bottle, compared to the previous version, is made with 100% recycled PET (+50%) and is 10% lighter. The weight of the cap has also been reduced by 38%. The packaging has also been simplified since the collar around the bottle has been eliminated and only the 100% recycled PPL label has been kept.* ***These interventions also produced positive effects on logistics activities, allowing the transport of 30% more product.*** | *1* | *0* | *0* | *1* | *0* | *1* | *1* | *0* |
| *Bticino S.p.a.* | *BTicino has replaced the packaging for adapters made up of a PVC blister and an internal sheet of cardboard with a new packaging made up of a polylaminate cardboard and LDPE film. This innovation has led to a reduction in the weight of the packaging by about 50% and, consequently, in the supply of raw materials for production.* ***Furthermore, the new system, considering a standard pallet, allows the transport of 75% more packaging than the previous version.*** *Bticino has a UNI EN ISO 14001 certified Environmental* | *1* | *0* | *0* | *1* | *0* | *1* | *0* | *1* |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Management System.* | | | | | | | | |
| *BB Line S.r.l.* | *BB Line, in collaboration with Leroy Merlin, has created the packaging for curtain rods which allows for an overall saving of 16% in raw materials and an increase in the percentage of recycled material for the cardboard which goes from 95% to 100%.* ***Finally, the smaller size of the packaged products has allowed for an important optimization of logistics.*** | *1* | *1* | *0* | *1* | *0* | *0* | *1* | *0* |
| *BB Line S.r.l.* | *BB Line, in collaboration with Leroy Merlin, has proposed a packaging that reduces the use of overall raw material by 42% with an increase in the percentage of recycled material for the cardboard which goes from 95% to 100%.* ***The smaller size of the packaged products has also allowed for a significant optimization of logistics.*** | *1* | *1* | *0* | *1* | *0* | *0* | *1* | *0* |
| *BB Line S.r.l.* | *The new packaging solution, proposed by BB Line in collaboration with Leroy Merlin, reduces the overall use of raw materials by 35% by proposing the accessories for the awning directly fixed to the cardboard, eliminating the previously used PVC shell. The cardboard used is made with 100% recycled paper (previously it was 95%).* ***Finally, the intervention carried out allowed an 80% increase in the number of products transported on standard pallets.*** | *1* | *1* | *0* | *1* | *0* | *0* | *1* | *0* |
| *BB Line S.r.l.* | *BB Line, in collaboration with Leroy Merlin, has created a new packaging for the line of accessories for awnings which includes numerous models. The previous solution consisted of a sheet of cardboard, containing 95% recycled paper, and a PVC valve which contained the curtain rods. For the new packaging, the valve has been replaced by a thin polyurethane strap that fixes the curtain rods to the cardboard, now made from 100% recycled paper. This modification has allowed an overall saving of 45% in raw materials and* ***a 50% increase in the product transported on standard pallets.*** | *1* | *1* | *0* | *1* | *0* | *0* | *1* | *0* |

From the description of the cases emerged that most of the innovations regarding the optimization of logistics consider the packaging as a system. Twede (1992) refers to the "packaging system", composed by three levels of packaging that can be distinguished (intimately related to logistics) in: primary packaging (or "sales packaging", or "consumer packaging"), secondary packaging (or "group packaging", or "distribution packaging"), and tertiary packaging (or "transport packaging"). This explicitly recognises packaging as a hierarchical system, the performance of which is affected also by the interactions between levels, and not only by the performance of each single packaging level (Hellstrom and Saghir, 2007). Very often the innovation on the primary packaging may have implications on secondary and tertiary, multiply the sustainable effect. This could be an implication useful for managers and academics working on packaging management not only in a "punctual" way, but with a systemic approach. The text in bold inside the description of the cases evidences the logistics implications, both qualitative (optimization of logistics) and quantitative (i.e. with the increased percentage of units per pallet or of units transported than the previous version).

All the cases presented a better impact after the packaging innovation project on the measurement of LCA. Only some of them (5) also have evaluated MPS, but with good results, between 35% and 80%: a higher value after the innovation initiative, with a positive effect on the amount of Secondary Raw Material generated. Table 5 shows in particular the LCA results, a life cycle assessment is a very important process to evaluate environmental burdens associated with a product, by quantifying the energy and materials used and the wastes and emissions released over the entire life cycle (Pauer *et al.*, 2019).

*Tab. 5: LCA.*

| | *N. cases with reduction >=50%* | *N. cases with reduction between 50% and 30%* | *N. cases with reduction <=30%* |
|---|---|---|---|
| *LCA - CO2* | *30* | *27* | *66* |
| *LCA - Energy* | *26* | *23* | *74* |
| *LCA - H2O* | *27* | *15* | *81* |

All the analyzed cases have reported reduced impact in comparison with the initial stage, before the implementation of the innovation, this underlines how important are the sample cases to guide packaging towards sustainability. Packaging can concretely contribute to achieving the business's sustainable development goals along the supply chain. The preliminary considerations underline that there are many concrete solutions for sustainable packaging, and that there are good results in terms of LCA analysis.

These results and considerations may be a useful comprehensive map for managers and practitioners embedded with packaging decisions who wish to experience similar projects, and also as a basis for more theoretical implications and research.

## 5. Conclusion

The sustainability challenges posed by packaging value chains require urgent actions inside the international and national sustainable product policy framework and industrial strategy. Along this way, the paper explored innovative solutions for eco-sustainable packaging considering the implications on logistics optimization with a specific focus on the potentiality of paper materials. Logistics assumes a key role for sustainable packaging innovation in theory and in practice, and paper packaging has a great potentiality as a valid substitute of plastic packaging very often.

After the literature review, the empirical exploration was run to briefly describe 123 successful cases of packaging innovations towards sustainability. The main results indicate that packaging can concretely contribute to achieving the business's sustainable development goals along the supply chain: there are many concrete solutions for sustainable packaging adopted by firms, and that there are good results in terms of LCA analysis. Managerial implications may arise from this research, as eco-packaging emerges as a key trend in the market: in fact this research presents real case applications that propose a comprehensive map for managers and practitioners interested in eco-sustainable innovations and who wish to experience similar projects.

Even if the paper permits some preliminary consideration on the topic, it deserves to be more developed especially in term of the analysis of the cases, inspiring also other stream of research.

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