PACKAGING IN CIRCULAR SUPPLY CHAINS: CHALLENGE FOR THE AUTOMOTIVE INDUSTRY

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Abstract

The transition to circular and environmentally sustainable supply chains is gradually taking hold for companies. In the case of France, it is strongly encouraged by public authorities which attach great importance to environmental issues. It is in this context that a research project has been initiated on the important issue of reducing the environmental impact of packaging in the automotive industry. This project is closely linked to the orientations of public authorities and existing and future regulations, including the AGEC law, as well as the company's strategic and environmental commitment. More concretely, this research project is at the dawn of a new technological revolution combining circular logistics and sustainable packaging. It aims to design a circular logistics system specific to B2B exchanges in the field of automotive construction. This concerns both the exploration of technologies to design sustainable packaging and cushioning elements, as well as the structural and organizational implementation of a circular logistics system to implement them. The presentation of this project is based on the highlights of the literature review, the presentation of the research program and the economic value of research work.

Keywords: *Circular economy, Industrial packaging, Sustainable supply chain, Waste.*

1. General Introduction

The circular economy and waste reduction have become a top priority in Europe. For example, the European Union (EU) Circular Economy Action Plan is part of the Green Pact for Europe and aims to define objectives and minimum requirements for the future. It is now up to industry to meet these requirements (European Commission, 2020). Awareness of the impact of production and consumption systems on the environment has greatly stimulated interest in the re-design of products, processes and services, the pursuit of sustainable use of raw materials, waste reduction and the implementation of sustainable development strategies. The maintenance of value and materials in products and waste is ensured by circular economy models. Industrial packaging is an essential component of many industries, including the automotive industry. While packaging is often criticized, industrial packaging can also enable efficient and sustainable logistics activities along supply chains (Silva and Pålsson, 2022). They protect products during transport and storage and play an important role in supply chain management. However, the traditional linear model of "*get, make, dispose*" packaging is not sustainable and increasingly inconsistent with the principles of circularity. It is clear that the choice of packaging is a key element when environmental issues are addressed in the context of logistics.

Therefore, many companies are looking to redesign their packaging to make it more sustainable and reduce waste. This may include increasing the use of recycled materials, designing reusable or recyclable packaging, and implementing *closed-loop* systems that keep materials in circulation longer. Although the automotive industry offers many possibilities for sustainable packaging solutions. For example, constrictors can use reusable packaging for parts and components, reducing the need for single-use packaging materials. They can also use more environmentally friendly materials, such as recycled plastic, to reduce the impact of their activities on the environment. These practices are still very marginal and at a very low threshold. The circular economy model thus comes to encourage economic actors to reflect on the full life cycle of their products and packaging. This means that automotive manufacturers can focus on reducing waste throughout the supply chain, from manufacturing to end-of-life disposal. They can also explore innovative ways to reuse or divert waste, such as using recycled plastic to make new parts or turning waste into energy.

Overall, the shift to a circular economy and waste reduction in Europe is bringing about changes in the way industries approach packaging, including industrial packaging in the automotive industry. Companies are exploring new and innovative solutions to make their packaging more sustainable, reduce waste and minimize their impact on the environment. By adopting circularity, companies can not only meet regulatory requirements, but also foster long-term sustainable growth. Given the impact of this issue on business performance, the challenges of industrial packaging research and its potential to contribute to sustainable supply chains and a circular economy are considerable. In this perspective, we have initiated a reflection on the issue of the circular economy and waste reduction in the context of industrial packaging. In order to specify the scope of the research, after the presentation of our scientific state of the art, we will detail our research program by explaining the questions structuring the research and the methodology that will be followed, as well as the economic value of the research work.

2. Literature Review

The issue of packaging and its induced waste is now central to the ecological transition (Ellsworth-Krebs et al., 2022). Yet the definition of sustainable packaging dates back only a decade (SSC, 2011). Sustainable packaging, to be considered according to its use (single or reusable, and in this case versatile or specific) and according to its cost, is characterized by its safety of use, its technical and economic performance and those of its manufacturing and end-of-life processes. Closed-loop reuse is only briefly mentioned, as a future solution dependent on new approaches and technologies, for an unspecified horizon. The specific problem of packaging comes from different points of view: adaptability vis-à-vis the transported object (polymorphic vs monomorphic) (Jahre and Hatteland, 2004), ergonomics vis-à-vis the handling and transport system, design and manufacturing conditions, operational suitability and end-of-life requirements. Thus, parallel considerations emerge around green packaging in logistics (Zhang & Zhao, 2012) and the paradigm of the Internet Physics (Montreuil, 2011; Meller et al., 2012): this is the main part of the encapsulation of the goods through the use of containers of standard sizes, reusable and associable in order.

We are indeed faced with a double paradox. In a few decades, practices have shifted from B2C returnable packaging to single-use disposable packaging (Fontaine, 2016) and from B2B to the widespread use of standard-size, reusable shipping containers (Levinson, 2006). Despite this, economic activities (B2B) generate much more packaging waste than households (B2C). Indeed, according to the Ellen MacArthur Foundation (2013), an average OECD consumer buys 120 kg of packaging each year. Globally, that is 207 million tons, equivalent to $384 billion. Industrial and commercial packaging accounts for almost double these volumes and values.

Today in Europe, packaging alone accounts for 36% of municipal solid waste. As countries around the world continue to fight waste management problems and resources continue to run out at a faster rate than they can be regenerated, the global economy loses about $80-120 billion in packaging that could be reused or recycled (World Economic Forum, 2016).

Studies show positive environmental externalities that would result from sustainable packaging practices. For example, Radhakrishnan (2016) posits such an impact study at the level of the Indian subcontinent and the CNE (2014) exposes the awareness of French professionals in the packaging sector. Babader et al. (2016) studied the different social aspects of reuse behaviour, including the value of the information transmitted, changes in awareness, and behavioural adaptation of users. Fulconis & Philipp (2016) analyse the evolution of packaging logistics functions in relation to their ability to promote the transition from a linear to a circular economy. This work initiated a real reflection on reusable packaging.

This reflection affects various industrial fields: logistics (Chung et al., 2018), consumer goods (Madria & Tangsoc, 2019), food (Saeter et al., 2020; Dey et al., 2021), pharmaceuticals (Hui et al., 2020), etc. The first states of art begin to be published (Meherishi et al., 2019; Coelho et al., 2020). In the automotive construction sector, Ghadge et al. (2022) have highlighted the link between sustainable supply chain management and new information technologies. The parts, components and sub-assemblies to be processed and assembled are fast-moving goods, especially in an almost generalized lean production context. This quantitatively amplifies the phenomena of related consumption of packaging. Thus, the packaging of these products is an important source of sustainable improvements to accompany the ecological transition if their re-use becomes the standard. There are already a large number of good practices that are operational, sometimes resulting from progress approaches on a given problem, without there being any structured approaches or standardization. This view is widely shared in recent publications (Schroeder et al., 2019; Kamble et al., 2020; Felsberger et al., 2020), which see in Industry 4.0, beyond productivity gains and flexibility, a strong contribution to the achievement of organizations' sustainability goals.

This point of view is also to be put in coherence with all the work on containerization conducted as part of the research on the Physical Internet. This vision of the logistics of the future, by 2030-2050, works on the concept of standard sizes of containers, associable two to two in a recursive way until it is possible to reconstitute a standard maritime container (Ballot et al., 2014). Significant advances in packaging have been presented as part of the European project Modulushca (Landschützer et al., 2015). The ability proposed in Sallez et al. (2016) for the aggregation/disaggregation of “p-tokenization” (process to secure data through the blockchain) of containers, routes are facilitated in logistics networks. Finally, inspired by (Ounnar & Pujo, 2010), Ounnar & Pujo (2019) combine the transport order of a logistics mission with the container: the latter then becomes an intelligent actor of its own transport, containers can be transposed to the packaging and its cushioning components. These various studies all show the importance of an appropriate information system favoring composition/decomposition mechanisms, pooling, and aggregation to the establishment of a vast management system of reusable packaging. In this sense, they are totally in line with the work of Ellsworth-Krebs et al. (2022) and Rosa et al. (2020), which encourage a detailed study of the digitalization of packaging.

This must be combined with a reflection on the development of packaging itself, and in particular on the cushioning devices, which constitute the bulk of the waste currently produced, and a reflection on their uses throughout their life cycle. This goes beyond the classic 3R ‘reduce, reuse & recycle’ (Fenton, 1994) to adopt the 7R of the Achterberg pyramid (Achterberg et al., 2016), which offers more possibilities to retain the added value of packaging, considered here as auxiliary devices, but not insignificant, logistical operations. On the basis of reuse, the

design of these devices can lead, through the choice of more suitable materials (less environmental impact, more sustainable (Rezaei et al., 2019; Coelho et al., 2020)), to greater robustness (allowing several uses without degradation, offering repair possibilities if necessary, etc.), the integration of an identification tag (as much to locate and track the package during logistics operations as to count the successive uses, etc.), an eco-design facilitating end-of-life (avoiding ultimate waste, either by mechanical treatments (Horodytska et al, 2018; Schyns & Shaver, 2021), or by biotechnological treatments (Shah et al., 2008; Moshood et al., 2022), at higher unit costs, costs which will be amortized by the re-use a number of times of the device. Associated with the logistical costs necessary for the reverse of this use, it is therefore necessary to find an organization that, in a systemic vision, guarantees the economic viability of the solution, beyond the ecological objective of waste reduction.

It is therefore at the dawn of a new technological revolution combining circular logistics and sustainable packaging that this research work is envisaged. This involves designing the circular logistics system specific to B2B customer-supplier exchanges in the field of automotive construction. This concerns both the exploration of technologies to design sustainable packaging and cushioning elements, as well as the structural and organizational implementation of a circular logistics system to implement them.

3. Research Program

In light of the simultaneous requirements of effectiveness, efficiency and implementation time frame to address the identified research problem, which also implies a long-term vision, this research work will focus mainly on the conditions necessary to successfully operationalize this project.

3.1. Research Questions

It is important to note that this issue is a common challenge for all automotive manufacturers, and the automotive manufacturer with whom we are collaborating aims to become a leader in this field. Therefore, the research will focus on how to implement the project effectively and efficiently, while being able to meet the long-term challenges and maintain a leadership role in the automotive industry. To begin, it will be essential to conduct a detailed supply chain analysis. This will include a quantitative and topological representation of packaging flows, waste generated and the potential for implementing circular practices in the future. In the specific context of the intended industrial application, three research questions (RQ) could be considered as the focus of this work.

RQ1. How can the quantitative complexity of the future circular organization of reused packaging be mastered? How to organize the rise of this future organization, i.e. how to consider the transition phase and the progressive implementation of return flows of reusable packaging and packaging devices?

The first research question helps to put in context the difficulty of setting up a circular organization for the packaging concerned, whether reusable or recyclable. This difficulty is due to different use situations, different logistical conditions, different management methods, etc. It is important to consider the circular organization of the packaging, in particular that of cushioning and protection systems that must become returnable, and the circular approach of disposable packaging, which will enter a reverse logistics circuit to be recycled. Packaging experts (CNE in particular) avoid the term "waste", because it is rather a matter of materials to be managed, processed, moved, upgraded, etc. However, the analysis of the industrial situation evokes many "recovery subsidiaries" and the existence of waste which should be reduced.

Thus, the question of reverse logistics is divided into two: that of returnable packaging and that of packaging to be recycled, with the stakeholders concerned (LSP and the manufacturer's suppliers for the first sub-question + LSP, sorting center, regulatory authorities, etc. for the second sub-question). A collaboration with the GALIA association is an interesting avenue to explore. The objective is to precisely define all the parameters of this plural logistic organization, the fields of variation, and to identify the main functional configurations to which the proposed circular organization will have to respond. Following this, the operational conditions of the transition will have to be decided, by choosing the strategy that appears to be the most effective: according to the type of products, by major flows, or by geographical or financial interest, etc.

RQ2. What are the challenges of introducing digital in the 'packaging' function to achieve this mastery? What information is relevant to the logistical task of packaging the product to be transported, and what information is relevant to the packaging operation cycle?

The initial questions raised in this paragraph lead to a more in-depth reflection on the role that digital functionalities associated with reusable packaging can play and on the steps necessary to implement a transition to digital. Indeed, the transformation towards the use of reusable packaging can offer considerable benefits in terms of sustainability and efficiency, but also requires significant organizational adjustments. It is therefore important to examine these changes from a pragmatic perspective in order to identify the key steps for successful implementation. In this context, it is crucial to formalize the specifications of the information system associated with each packaging. This will make it possible to consider the digital identification of the reusable packaging as such, but also that of the packaging containing a load that has its own identifiers, in accordance with existing digital standards (ODETTE, 2021). Similarly, it is essential to identify packages containing a load and assign numerical identifiers to them. This approach will make it possible to optimize flow management and ensure compliance with the regulations in force.

In addition to the numerical identification of packaging, it is also important to consider cushioning devices. These devices, while essential for safety, are often considered to be waste after use. However, by adopting a circular approach, these devices can be valued and reused. It is therefore necessary to rethink their status and develop solutions for their reuse, in order to limit the environmental and economic impact of waste management. In summary, the transition to reusable packaging requires careful consideration of the necessary organizational adjustments. The formalization of the information system specifications associated with each packaging is a key element of this approach, allowing the management of flows in an automated and secure manner. Similarly, the digital identification of each package is essential to ensure complete traceability and compliance with the regulations in force. Finally, it is important to rethink the status of benchmarking devices and develop solutions for their reuse, in order to promote more sustainable and responsible management of resources.

RQ3. How to organize information sharing between stakeholders (OEMs, end plants, logistics service providers (LSP), other automotive manufacturers, etc.)? How can we make the most of the service provided by each of the stakeholders, so that each one finds its interest in it beyond advances in the environment?

The third set of questions addresses the issue of disseminating information to stakeholders involved in the management of reusable packaging. This dissemination of information raises issues of standardization, security and robustness of associated data. To respond to these challenges, it is crucial to mobilize all the actors concerned and to ensure their long-term commitment, considering the work carried out on the management of inter-organizational

relations in a cooperative logic. The question of the trust and commitment of the various stakeholders is central to this approach. It is essential to think about how to mobilize stakeholders and involve them in this process over time. Work on cooperation has highlighted the importance of building trust relationships for the success of such an approach. It is therefore necessary to consider how to foster this trust and commitment, considering the interests of each stakeholder.

A careful reflection on a fair distribution of the respective costs of each is also necessary. Such a mechanism must allow each stakeholder to win. This can be achieved through the implementation of a cost-sharing system, in which each stakeholder contributes according to its means and interests. This approach promotes cooperation and collaboration, allowing each stakeholder to benefit from the approach while limiting the associated costs. In summary, disseminating information to stakeholders is a crucial issue in the management of reusable packaging. It is essential to mobilize all the actors concerned and to ensure their long-term commitment by fostering the creation of relations of trust. A reflection on a fair distribution of the respective costs of each is also necessary to foster cooperation and collaboration. By taking a collaborative and cooperative approach, it is possible to ensure the success of the process and maximize benefits for all stakeholders.

3.2. Methodology and Expected Results

This research work aims at proposing a new approach for the 'packaging' function in the B2B logistic flows for the automotive industry. To do so, it is articulated around three main axes.

The first axis will consist in confronting real practices with theoretical knowledge to better understand the B2B packaging practices of the automotive manufacturer. A literature review will be carried out to identify patterns and trends in the field, while considering the specificities of the automotive industry. A comprehensive approach will be adopted in order to understand the complexity of the object of study, i.e. the B2B packaging practices of the manufacturer, based on the visions, interpretations, languages and intentions of the actors in the field. This research approach is part of a constructivist paradigm that emphasizes the construction of knowledge by the actors involved. In order to achieve this aim, reasoning by abduction will be used to draw up conjectures that will be tested in the field.

The second axis will aim at proposing a logistic organization for the packaging function, considering technical constraints related to packaging characteristics, reusable and/or recyclable packaging devices, imperatives related to the object to be transported (fragility, surface, volume, rates, etc.), digital identification solutions (digital tag, QR code), and the capacity of stakeholders to adopt the necessary changes. This integrated approach will enable the design of a more efficient and sustainable logistics organization for packaging management.

Furthermore, the third axis will focus on the analysis of the B2B circular logistics system and the flows of recyclable and/or reusable packaging in order to confront the prevailing economic and environmental models. This approach will allow us to propose innovative solutions to improve logistics efficiency and reduce the environmental impact of the packaging function. The analysis of the B2B circular logistics system will focus on the collection, reuse and recycling of packaging, as well as on the optimization of logistics flows to reduce costs and improve environmental sustainability. This diagnosis will be confronted with the prevailing economic and environmental models to propose innovative and sustainable solutions for the management of packaging in the automotive manufacturer's B2B logistics flows.

4. Economic Value of Research Work

This research is part of a two-pronged climate action plan, namely the reduction of packaging waste (framework directives on waste) and circularity in line with the circular economy plan. The project aims to reduce packaging waste through a comprehensive and economically feasible analysis.

4.1. Context of the research theme

The transportation of automotive parts required for the assembly of automotive manufacturer's vehicles involves the use of a wide variety of packaging from different suppliers and destined for various destinations. Depending on the mode of transport and the distance to be covered, returnable or disposable packaging may be used. This packaging can be standardized for a variety of parts or specific to a given part. In addition, to ensure the quality and conformity of parts after transport, cushioning and protective materials are used to ensure that the parts are not damaged. The former automotive manufacturer is committed to becoming an environmentally friendly organization, aiming for carbon neutrality, sustainable sourcing and a strong circular economy model as part of its "Green as Business" strategic focus. To this end, the company aims to reduce the environmental impact of packaging, reduce packaging-related waste by 20% by 2030, eliminate single-use plastic by 2030, increase the rate of recycled material in packaging, improve waste sorting and recycling, and reduce the weight of packaging. However, the company must also remain profitable while developing new solutions, new materials to replace single-use plastic and considering new ways of managing packaging.

Moreover, implementing these more sustainable solutions is complex and requires the cooperation of thousands of suppliers, specific contracts between suppliers and customer factories, as well as the millions of standard packages already in circulation. Consequently, the transition to more sustainable solutions must be organized in an effective and efficient way to avoid a delay of several decades. The issue to be handled is of considerable size and requires in-depth academic and managerial reflection to ensure a successful transition to a more sustainable way of operating. This transition cannot be accomplished by focusing solely on eco-design or material selection issues. Indeed, it is crucial to consider the whole ecosystem and to consider the new sustainable issues that are linked to it, as well as the regulatory requirements that accompany them.

This holistic approach implies rigorous management of all components of the ecosystem, including natural resources, production processes, supply chains and consumption patterns. It also requires a thorough understanding of environmental and social issues, as well as an ability to anticipate changes that may occur in the near future. Hence, the transition to a more sustainable way of operating implies a long-term vision and strategic thinking which must be integrated in the daily management of companies. It also calls for close collaboration between the different actors involved, including businesses, governments, NGOs and consumers, to guarantee a smooth transition to a more sustainable future for all parties.

4.2. Ecological and industrial relevance of research work

The circular economy of packaging is a concept that has been practiced for many years, although the associated activities were not always referred to as such. As part of its industrial activities, the automotive manufacturer has progressively introduced measures to reduce its environmental footprint and limit its waste production. As a result, more than 97% of the cubic meters delivered to its plants are already transported in returnable outer containers, which allows it to minimize the use of disposable materials. Despite this, packaging still generates tens of thousands of tons of waste each year at its industrial sites, which encourages it to

continue its efforts to find more sustainable and greener solutions. A closer look at the sources of these wastes shows that half of them come from disposable wood or cardboard marine outer containers. while the other half comes from protective and cushioning materials used for land and sea transport. To remedy this situation, the aim is to develop more environmentally friendly alternatives, such as reusable or recyclable packaging, in order to reduce the impact of B2B activities on the planet.

Around the world, many companies are committed to promoting the circular economy of packaging by seeking to upgrade the waste generated by their activities. On average, 85% of this waste is already recycled by recycling the material, which is a significant step forward in the fight against waste and pollution. However, when it comes to single-use plastics, about two thirds of packaging solutions contain them, with a wide variety of types of plastic fittings such as bags, covers, films, foams, thermoformed trays, Unfortunately, these plastics are very difficult to recycle, which forces companies to look for more environmentally friendly alternatives. This represents a major challenge for the entire industry, which must adapt to a changing market to meet the expectations of consumers and regulators. Finally, it should be noted that standard returnable packaging in Europe is mainly collapsible and pool managed, so that empty packaging can be returned to the nearest supplier who needs it. This practice reduces the number of trucks needed for transport and the distance travelled by empty packaging, which helps to reduce the environmental impact. In short, the circular economy of packaging is a crucial issue.

For the automotive manufacturer, the company has put in place various measures to achieve sustainability objectives. However, these measures are not enough, as much remains to be done. The manufacturer is working with its material suppliers to find alternatives to plastic, which is a very common material used in packaging and cushioning materials. However, this is difficult because of the multiplicity of use cases, which makes the search for alternative solutions more complex. In addition, the company is experimenting with new waste recovery schemes, such as expanded EPP plastics. The goal is to reduce their volume to minimize transportation costs and thus reduce the environmental impact of their disposal. This approach also creates new sources of raw materials from waste, which could be reused in other production processes. However, the reuse of pallets, wood packaging or certain cushioning materials is complicated by administrative, computer or customs obstacles. Despite this, the automotive manufacturer is currently studying the economic model of its standard packaging pool to optimize their reuse or recycling. Finally, in order to work together and accelerate the transition to sustainability, the constructor plans to create a working group in collaboration with other French manufacturers and equipment manufacturers. This working group will be created through the GALIA Professional Association, and will allow to work together to implement sustainable solutions for the entire industry. This initiative will share best practices, ideas and innovations to accelerate the transition to a circular and sustainable economy.

The automotive constructor is committed to ensuring that the packaging used in its operations complies with the company's ecological transition to carbon neutrality and future regulations. The company is aware that packaging is often a major source of waste and pollution and is therefore committed to reducing their environmental impact. In addition to the main objective of meeting these environmental standards, He also expects financial and branding benefits.

Reducing the overall cost of packaging is one of the major economic benefits sought by the company. This could be achieved by reducing the amount of single-use materials, reducing the cost of waste treatment or improving the recovery of the material. By streamlining packaging and storage processes, the automotive manufacturer hopes to reduce the costs associated with handling and transporting packaging. Reducing the amount of packaging used could also reduce

storage and handling costs. In addition, he seeks to improve the efficiency of its packaging pool by creating an open ecosystem that promotes synergies and the reduction of disposable packaging and fittings. This could reduce the amount of waste generated by the company and promote the reuse of materials. Furthermore, by taking the initiative to reduce its environmental impact, the manufacturer wants to show its commitment to the environment and improve its brand image. As a responsible organization, the manufacturer wants to encourage its customers, partners and suppliers to adopt more sustainable and environmentally friendly practices.

4.3. Description of Research Activities

Research activities will be organized in several logical phases. The first phase will be devoted to integration within the automotive manufacturer, in order to become familiar with the various facets and issues related to packaging issues. At the same time, a literature review will be carried out, which will be extended to internal manufacturer's documents. In a second phase, work will be carried out to assess production situations that require the use of reusable packaging and to identify the technical solutions proposed to achieve this. Also, a brainstorming to broaden the field of possibilities. The objective will be to replace single-use plastic by proposing new packaging solutions, eco-designed, integrating new materials and capable of reducing or eliminating waste in different packaging situations. To reinforce the research team's skills in this area, the hiring of a M2-level intern specialized in materials and eco-design will be considered. A multi-criteria analysis method to propose the best B2B packaging solution depending on the industrial situation may also be considered.

At the same time, these packaging solutions will have to be considered as part of the digitalization of information. The way to implement this digitalization of information will be the subject of a further bibliographic study around technologies applicable in the workshops (RFID, NFC, IoT, CPS, WHN, etc.). This technology will need to be robust and allow automation of flow management to be compatible with the fast-moving packaging environment. The robustness of the information system will make it possible to imagine new modes of management of reusable packaging in a circular way, under conditions of efficient economic implementation. This industrial approach aims not only at operational and engineering efficiency, but also at a strategic and proactive approach to reduce the environmental impact of B2B packaging. It is thus a strategic and logistical approach, in the direction of strategic management and SCM.

Finally, the final mission will be to organize the transition to the desired circular logistics system, despite the complexity of the automotive manufacturer's global ecosystem (thousands of suppliers, tens of thousands of parts, existing packaging assets, etc.). To do this, it is necessary to organize the implementation of a POC (Proof of Concept) by simulating the flows of the circular logistics system B2B based on operational data corresponding to a given perimeter, or with an operational deployment on a given perimeter.

5. Conclusion

The research project conducted with the automotive manufacturer and presented in this paper does not only focus on the technical aspects of packaging in B2B logistics flows, but is also positioned in a broader strategic perspective. It has a twofold aim: on the one hand, to strengthen the ability to adapt to current or future regulations, and on the other hand, to develop the ability to be a vector of change, in a proactive posture, by wishing to be a leader in the reduction of the environmental impacts of B2B packaging in the broadest sense (Reduction of packaging-related waste: - 20% between 2019 and 2030; elimination of single-use plastic by 2030; increase in re-use, re-cycling and the circular economy; increase in the rate of recycled material in

packaging; improvement of sorting, effective recycling; reduction of the weight of packaging). This project is therefore clearly part of an approach that is both strategic (in the sense of strategic management as a disciplinary field), and logistical (in the sense of "logistics management" and SCM) as understood in Management Sciences and Management (Fulconis and Paché, 2022).

The research project also seeks to propose best practices for organizing the transition to the desired circular logistics system. It should be noted that the global ecosystem of automotive manufacturers is complex, with thousands of suppliers, tenths of thousands of parts and many existing packaging assets. Finally, beyond the new solutions and management methods to be invented, there is yet an additional major problem: the size of the existing ecosystem, with thousands of suppliers (not yet involved in this approach), tens of thousands of packaged part flows (each flow being subject to a specific contract between the supplier and the client plant, which has a say in the quality of the incoming part, integration at the workstation, safety and ergonomics for operators, etc.), as well as an asset of millions of existing standard packages.), as well as an asset of millions of existing standard packages. How could the transition to more responsible solutions be organized effectively and efficiently and without spending several decades?

Overall, this research project takes both a strategic and logistical approach to strengthening the operational and engineering efficiency of the constructor's B2B packaging logistics flows. By proposing best practices to organize the transition to a circular logistics system, the automotive manufacturer seeks to be a leader in reducing the environmental impacts of B2B packaging.

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