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Packaging scorecard for closed-loop logistics systems: a sustainable development perspective

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Abstract

Packaging is omnipresent in modern production, distribution and consumption systems. It has multiple functions. They refer to the quality of the products it covers, their advertising/ promotion via its marketing aspects and to the logistics via handling/ storage/ transportation activities it enables. Indispensable partner of different supply chain actors (suppliers, manufacturers, logistics service providers, carriers, wholesalers, retailers, consumers), it is at the heart of packaging scorecards developments since the beginning of our millennium. However, facing the paradigm change heralding the dawning transition towards a circular economy, what about the relevance of these packaging scorecards adapted to a linear supply chain conception? Having studied the imminent relationship between packaging, logistics and circular economy, this article questions the relevance of extant main packaging scorecards and lays the foundations of a new packaging scorecard deliberately oriented towards the circular economy principles.

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1. Introduction

According to Michel Fontaine, President of the CNE (French Packaging Association), packaging could be qualified as “*beautiful stranger*” in our societies (Fontaine, 2016). However, having a closer look we notice that packaging is at the heart of manufacturers’, distributors’ and consumers’ or - in a word - any supply chains’ actors’ everyday lives. Surprisingly, it is often ignored, unknown, even unloved or demonized, because one becomes completely aware of its presence only once it adopts the “waste” status. But how to preserve and protect the product without a packaging? How to store and moved it around within warehouses, distribution centers and logistics platforms? How to transport it over both short and long distances, whether with simple vehicles or for multimodal/ intercontinental transportation? How to distribute it and make it available to the consumer or - considering the increasing proliferation of the e-commerce - forward it until his home? Isn’t it the packaging once again that avoids or limits (food) waste, by extending the products’ lives? That enables to consume them whenever and wherever the consumer wants? By doing so, the packaging plays a main role within logistics activities and processes that go far beyond its product protection and promotion aspects (the famous “silent salesman” cited in our marketing textbooks), not to even mention at this stage the information it contains and that make supply chains more performing (Jantzen & Alexander, 1969; Hellström & Saghir, 2007; Verghese & Lewis, 2007; Dominic, 2010; Molina-Besch & Pålsson, 2016).

But its role does not terminate there! Adopting a sustainable development perspective, packaging’s role is from now on strengthened vis-à-vis the advent of new research issues related to the principles of an economy labelled ‘circular’ (Sanders, 2012; Le Moigne, 2014; Aurez & Georgeault, 2016). In other words: the packaging seems to become a vector of utmost importance in order to foster the transition towards circular economy. As stressed by François-Michel Lambert, President of the French Circular Economy Institute (see website: www.institut-economie-circulaire.fr, accessed April 16, 2017), “*this economy breaks with the traditional scheme of a linear production, transiting directly from the product use to its destruction stage, replacing it by a ‘loop’ logic that looks for positive value creation at any phase, avoiding waste of resources while guaranteeing consumer satisfaction*”. Conducting the state of the art on this issue, while intentionally positioning logistics functions of packaging (LFP) at the center of our proceeding, suggests formulating two research questions: the first one adopts a static approach (RQ1), the second one a dynamic approach (RQ2) of LFP.

- RQ1: what LFP components are susceptible of fostering or hindering transition towards circular economy?
- RQ2: what logistics / SCM competencies and skills have to be mobilized or developed to increase LFP components’ performance, while fostering transition towards circular economy?

In order to answer these RQ, the “packaging-logistics-circular economy” linkage has been studied beforehand (section 2). Based upon this preliminary work and considering the related paradigm change, we then question the relevance of main extant packaging scorecards (section 3). Having noticed that they do not consider sufficiently the circular economy issue, we have laid the foundations of a theoretical model of a packaging scorecard suitable for circular economy (section 4).

2. “Packaging-logistics-circular economy”: an unprecedented relationship within a sustainable development context

For some years already, academic literature has looked into the relationship between sustainable development and logistics, whereas the link between circular economy and logistics has been studied only recently, without being less promising (Fulconis, Paché, & Reynaud, 2016; Colin, 2017). Indeed, transition towards a circular economy is deliberately based upon a multi-actors’ logistics approach of our production/ distribution/ consumption systems. In that respect, Lévy and Aurez (2014) define circular economy as “*an arrangement targeting various organization levels: scientific, technological, economic and social organizations. Circular economy strives for returning to nature all gaseous or solid material flows, instead of borrowing them too dangerously from nature as humans used to do. This concept has to be implemented in urban planning schemes according to a double territorial governance*”

and ‘flows governance’ principle”. Circular economy represents an economic model that contributes to the rise of a “veritable sustainable development” (Gallaud & Laperche, 2016).

Hence, circular economy describes an economic model that most often has been initiated by a political or governmental body and that strives for fostering the economic development of a considered territory (Lazzeri, Bonet-Fernandez, & Domeizel, 2017), while preferring a closed-loop circulation of physical, water and energy flows as well as exchanges (see Fig. 1). It is close to the “industrial ecology” concept (Park, Sarkis, & Wu, 2010), imitating the operating principle of natural eco-systems that are characterized by autonomous organizational capacities and information feed-back mechanisms (Zhu, Sarkis, & Lai, 2008).

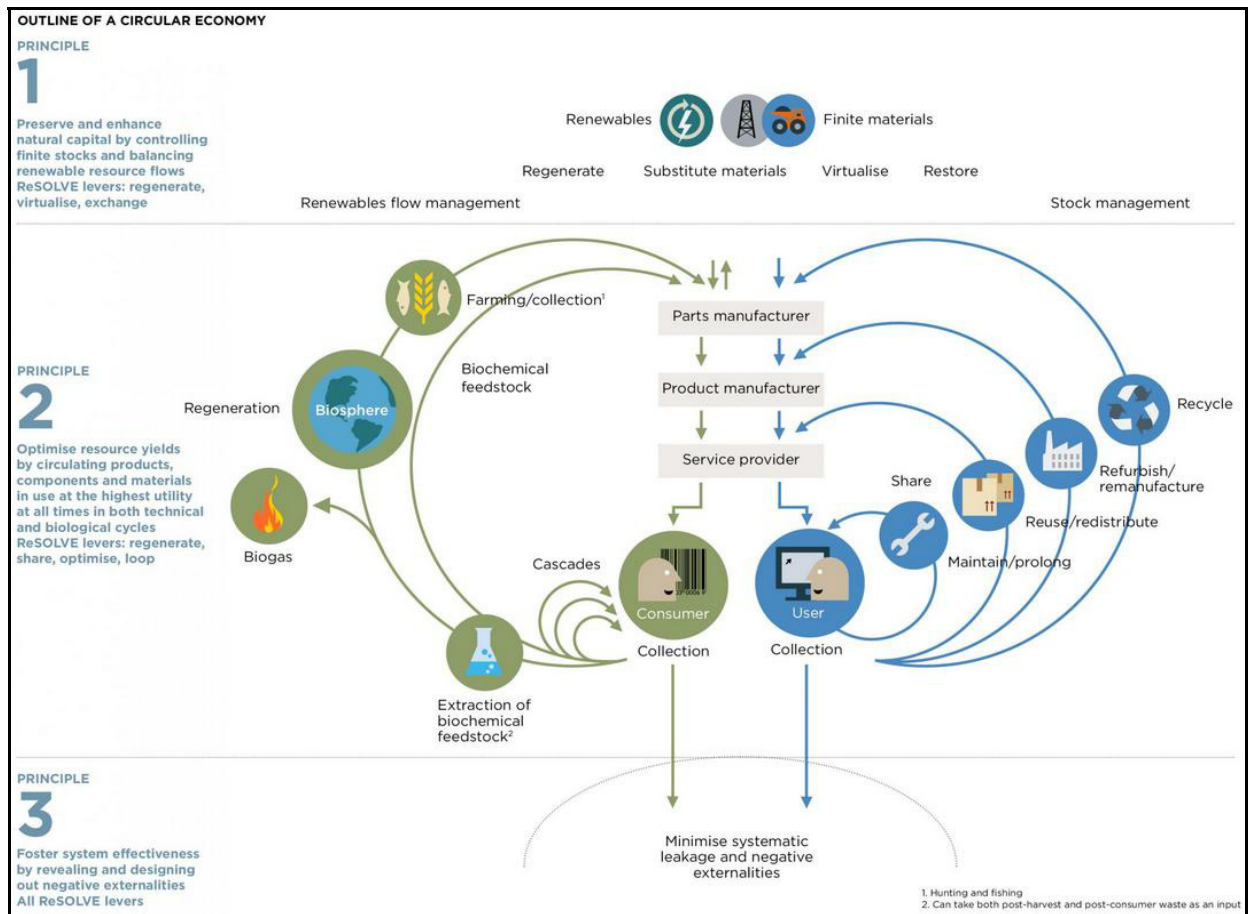


Fig. 1. Circular economy system diagram.

Source : Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment; Drawing from Braungart & McDonough, Cradle to Cradle (C2C). <https://www.ellenmacarthurfoundation.org/circular-economy/interactive-diagram> (Accessed March 09, 2017).

More recently, the French Montaigne Institute confirmed in their report that all circular economy definitions “converge towards an economic growth objective labelled ‘sustainable’: continue to create value while reducing negative externalities and extraction of natural resources” (Institut Montaigne, 2016). This institute puts three main features at the heart of circular economy: growth, innovation and collaboration. At the same time, Buttin and Saffré (2016) suggest to conceal economy and nature by “activating” circular economy. In the same manner, the CNE published in 2014 a report on the links between packaging and circular economy.

The report specifies that “*in the packaging sector, the circular economy model is about more than just recycling. It handles all stages of a product's lifecycle, namely: its design, production, distribution and use, but also its recovery. It includes notions such as local integration and proximity*” (CNE, 2014). Following this deliberately circular vision of a packaging's life, the report also underlines the central position held by resources' savings (materials, water, energy), achieved *via* various proceedings (design for the environment of the “product-packaging” pair, packaging reuse particularly within B2B settings, packaging waste prevention, improved recyclability, loop-closing *via* material reuse etc.).

Not only have these packaging practitioners perfectly seized the circular economy issue, they also demonstrate high levels of insight concerning its embedding in the packaging setting through its logistics dimension. In this respect, the CNE association published another report in 2015, then dedicated to packaging as a “*key element in product logistics*” (CNE, 2015). Above all, the report highlights that any “product-packaging” pair has to “*fit with the entire packaging system (primary, secondary and transport packaging), while integrating circular economy-related strategies (design for the environment, recyclability, reverse logistics, pooling of resources between parties etc.) according to a holistic view, because business choices made at a certain supply chain location might impact another point of the chain: the economic model chosen by one party of this logistics chain entails consequences for the economic model of other parties*” (CNE, 2015).

The use of a sustainable packaging scorecard is derived from the company's basis overall ecological strategy or attitude anchored at the corporate level: academia distinguishes proactive, adaptive or resistant ecological strategies (Meffert & Kirchgeorg, 1998; Reynaud, 2010). Accordingly, drivers stem from regulation (e.g. the proposal for a directive of the European Parliament and the Council on packaging and packaging waste 2015/0276) for adaptive companies, whereas proactive organizations consider packaging scorecards or other sustainable initiatives as competitive factors; companies following the resistant strategy consider environmental activities as antagonistic to business success.

Concerning these topics, we notice that some scientific contributions converge with the thoughts of many packaging value chain actors (packaging material suppliers, packaging producers, consumer marketing companies, distributors, green dot operators, local authorities, consumers' and environmental associations, designers, machine producers and other packaging professionals). For example, Massaroni, Cozzolino and Wankowicz (2014) stress that *sustainable supply chain management* needs “*sustainable packagings*”. Through their exploratory study, the authors highlight that the “*network organizations*” should be the preferred approach in order to seize the multi-industries/ multi-loops/ multi-professions dimensions, and in order to match with both vertical and horizontal interplays of those skills and competencies that supply chain actors have to mobilize. In the same manner, García-Arca, Prado-Prado and Gonzalez-Portela Garrido (2014) propose a dedicated “*sustainable packaging logistics approach*” for supply chains, but without referring to circular economy or closed-loop logistics concepts.

That's why some authors have recommended - already since the beginning of the millennial - a resources-based approach in order to study packaging related issues (Jahre & Hatteland, 2004). As opposed to alternative approaches considering packaging as a simple logistical activity, these authors favour a packaging conception interpreting it as a resource that is connected with other resources. Consequently, packaging interfaces with multiple other resources, such as products, logistics infrastructures, but also with actors and related logistics/ SCM skills and competencies. More recently, Ghisellini, Cialani and Ulgiati (2016) provide an extensive literature review of last the two decades, “*with the purpose of grasping the main circular economy features and perspectives: origins, basic principles, advantages and disadvantages, modelling and implementation of circular economy at the different levels (micro, meso and macro) worldwide*”. Their study underlines that circular economy “*implies the adoption of cleaner production patterns at company level, an increase of producers and consumers responsibility and awareness, the use of renewable technologies and materials (wherever possible) as well as the adoption of suitable, clear and stable policies and tools. The lesson learned from successful experiences is that the transition towards circular economy comes from the involvement of all actors of the society and their capacity to link and create suitable collaboration and exchange patterns*”. In summary, according to these authors, the circular economy transition “*has just started*” and “*the interdisciplinary framework underpinning circular economy offers good prospects for gradual improvement of the present production and consumption models, no longer adequate because of their environmental load and social inequity*”. Through the lens of above developed multi-actors and multi-competencies approaches, we have looked into the relevance of extant main packaging scorecards, susceptible to support decision making.

3. About the relevance of existing packaging scorecards

Frequent attempts to develop instruments for measuring company activities can be observed for almost three decades now. Amongst them, Kaplan and Norton's (1992; 1996a; 1996b) prospective *Balanced Scorecard* is one of the most notorious representatives (see Fig. 2). It has been tailored to various applications such as procurement (Procurement Executives' Association, 1996) or packaging and logistics (Johnsson, 1998). Beyond its simple measuring instrument capacities, Olsmats and Dominic (2003) recognized its potential of business strategy formulation and reorganization according to a holistic approach. Favouring this packaging approach and given the fact that supply chains become increasingly longer and complex, these authors proposed a tailored packaging tool, labelled "*Packaging Scorecard*" (Olsmats & Dominic, 2003). Proposing a dedicated packaging scorecard is justified by the economic importance of this industry: According to the Ellen MacArthur Foundation (2013), an OECD citizen buys 120 kg of packaging per annum. Transposed to the whole planet, this represents 207 million tons with a value of USD 384 billion each year. Industrial/B2B packages represent about twice the mentioned consumer volumes and values. In Western nations the packaging sector usually ranks among the top ten industries; for example, the French annual turnover amounts to at least € 23 billion (details of packaging market characteristics in France, Europe and the world available online at: www.france-emballage.org/chiffres-cles/). It is indeed hard to find an unwrapped product today – almost everything is packed. Another reason d'être of a dedicated packaging scorecard relies in its inherent "product – packaging" pair logic, providing guidance on interdependent/antagonistic situations, illustrated by the trade-off "product waste" vs. "packaging waste" issue, highly relevant for decisions related to circular economy performance.

This scorecard is original, as it considers the different supply chain actors. It assesses the packaging role and functions at each actor's stage, in order to increase its performance. Their theoretical framework for a packaging scorecard is presented in Table 1 and, according to Olsmats and Dominic (2003), "*summarizes functional criteria (marked X) that are typically the most significant ones for different actors along the supply chain and can serve as a base for the creation of the applied packaging scorecard*". Ultimately, this packaging scorecard also strives for final customer satisfaction – common goal for all supply chain actors.

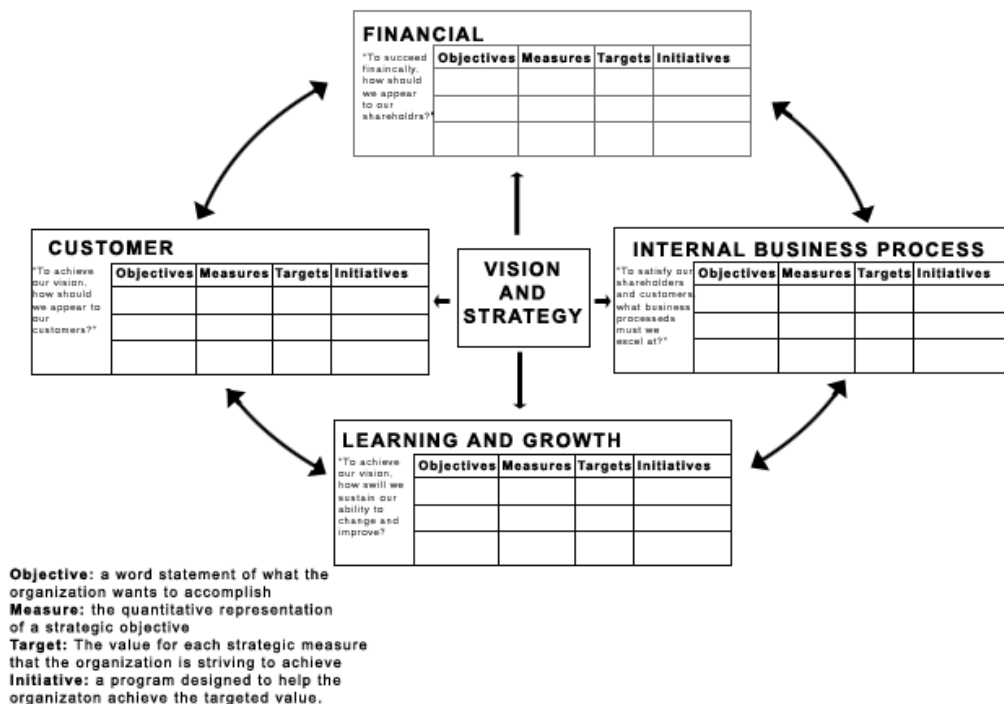


Fig. 2. Translating vision and strategy: four perspectives (Kaplan & Norton, 1996b).

Table 1. Criteria for the packaging scorecard.

| Criteria | Supplier | Transportation distribution and wholesale | Retail | Consumer |
|------------------------------------|----------|---|--------|----------|
| Machinability | X | | | |
| Product protection | X | X | X | X |
| Flow information | X | X | X | |
| Volume and weight efficiency | X | X | X | |
| Right amount and size | | X | X | X |
| Handleability | | X | X | X |
| Other value-adding properties | X | | | X |
| Product information | | | | X |
| Selling capability | | | X | X |
| Safety | | | X | |
| Reduced use of resources | X | | | |
| Minimal use of hazardous substance | X | | | X |
| Minimal amount of waste | | | X | X |
| Packaging costs | X | | | |

Source: Olsmats & Dominic (2003).

Based upon a search of functional packaging criteria, Olsmats and Dominic (2003) have developed a more holistic approach of packaging's contribution to value creation throughout the supply chain(s). In the same vein, one also observes several company-side initiatives, illustrated by the Walmart example started in 2006. That year, the U.S. number one retailer unveiled its own packaging scorecard to suppliers. According to a report of the company, "*Wal-Mart's packaging scorecard is a measurement tool that allows suppliers to evaluate themselves relative to other suppliers, based on specific metrics*" (Walmart, 2006). The metrics in the Walmart's packaging scorecard evolved from a list of favourable attributes known as the "7 R's of Packaging":

- Remove: eliminate unnecessary packaging, boxes or layers, and harmful materials.
- Reduce: "right-size" packages, optimize material strength, and design packages appropriately for contents and merchandising requirements.
- Reuse: Walmart has a goal that all transport packaging will be reused or recycled through improved pallets and reusable plastic containers (RPCs).
- Renew(able): use materials made of renewable resources as measured using ASTM D6866, or select biodegradable materials that meet ASTM D6400 or ASTM D6868.
- Recycle(able): use materials made of the highest recycled content without compromising quality, including post-consumer recycled material (PCR) where appropriate. Components should be chosen based on post-use recyclability, with a goal of increasing the municipal recycling rate to 35 percent in 2011.
- Revenue: achieve all principles at cost parity or allowing for cost savings, through a supply chain approach.
- Read: get educated on sustainability and how suppliers play a part at this.

However, and without devaluing their originality based upon a multi-actors' focus, the initiatives found so far are limited in number and mostly restricted to a linear supply chains' logic. The packaging scorecard proposed by Olsmats and Dominic (2003) indeed follows a simplistic segmentation of supply chains, considering only four categories: supplier (a), transportation distribution and wholesale (b), retail (c) and consumer (d). However, a circular conception of the economy requires the consideration of new actors, as mentioned above. Beyond the sole manufacturer/ distributor company unit, it indeed seems indispensable to include in our analysis the roles of the *reverse supply chain* actors, as well as those of the consumer (who wouldn't be any more the last and accessory link of the chain, but would become a full member within a closed-loop logistics chain), and those of eco-organisms, associations, researchers and, more generally, public authorities representing a stakeholder - if not the driver - of the transition towards the circular economy. Business-side, Walmart's packaging scorecard also follows a linear supply chain logic rather than a circular one, completely excludes the social dimension of sustainability and seems primarily driven by economic goals such as stimulating competition amongst the retailer's suppliers.

Clearly, a packaging scorecard adapted to a circular conception of economy becomes indispensable. Beyond traditional packaging criteria such as those preferred by Olsmats and Dominic (2003) (see Table 1) who had recognized their universal relevance for all the different supply chain actors, additional functional packaging criteria stemming from more encompassing dimensions, as well as those stemming from novel dimensions have to be considered according to the concerned actors of the considered chain. Thus, the new packaging scorecard will have to integrate other goals, considering the articulation between circular economy and the politico-economic sphere, whereas the traditional scorecard simply aimed at final customer satisfaction.

4. Packaging scorecard and circular economy: foundations of a research model

Laying the foundations of a novel packaging scorecard intentionally oriented towards the circular economy gives rise to two types of criteria: firstly, traditional ones that are suitable for further quantitative assessment once they have been repositioned according to their underlying new topics and, secondly, new ones related to logistics/ SCM competencies and skills susceptible to strengthen LFP components' performance, while fostering the transition to a circular economy. Consequently, we can distinguish two levels of analysis reflecting our two research questions as formalized above.

According to the first research question (RQ1), it seems necessary to identify those LFP that foster or hinder transition towards a circular economy. The packaging scorecard we consider for further development adopts two elements from Olsmats and Dominic's (2003) initial model: the respective weight of each LFP criterion and the achieved score. Its orientation towards the circular economy becomes visible through its potential to integrate, in addition to the considered packaging loop, wider loops relevant for other applications (considering various actors or stakeholders beyond traditional B2B and B2C logistics) and through its inclusion of all three packaging systems (primary, secondary and tertiary ones) (CNE, 2015). In the same manner, and in line with the definition of the circular economy, the novel packaging scorecard is suitable for multi-cycles, multi-links, multi-actors and multi-industries research issues. More precisely, the whole set of our LFP elements includes: machinability, product protection, protection from waste, transport, storage, flow information, volume and weight efficiency, right amount and size, handleability, product information, packaging cost, stackability, easy packaging sorting, easy product sorting, reversed product handling/easy discard, and reversed packaging handling/easy discard. We also include "other" packaging properties adding environmental and social value that are closely related to logistics, but are also interfacing with other spheres such as recycling: environmental consideration, reduced use of resources, minimal amount of waste, minimal use of hazardous substances, minimal amount of emissions, easy product recycling, easy packaging recycling, social norms, actors protection/safety – security, and selling capability. We are aware of a holistic concept ready to be adapted to a specific context (e.g. by defining the territorial radius of action) in order to generate meaningful results.

The case study research strategy seems particularly promising for packaging scorecards, as it allows adaptation to specific industries and/or product categories showing different modalities for primary and secondary packages (Pålsson & Hellström, 2016). Pålsson and Hellström (2016) apply Olsmats and Dominic's (2003) packaging scorecard for 22 product category-specific cases, using three scorecards for each case, one per packaging level (primary, secondary, tertiary). Analyses are conducted for each supply chain actor or node (manufacturer, distribution center, retailer), divided into the whole packaging system ("system performance") and each packaging level. On the other hand, Pålsson and Hellström's (2016) analysis follows a linear conception of supply chain actors rather than the loop design related to the circular economy philosophy and, consecutively, considers less "assessors" and does not distinguish neither between product-centric and packaging centric loops.

Following the second research question (RQ2), and having identified the LFP components and their respective weight, one now has to mobilize - internally or externally - logistics/ SCM competencies and skills in order to reach a settled LFP-related performance level. These competencies and skills often appear at different levels with regards to the LFP definition. Identifying LFPs indeed takes place at the design/ development/ innovation stage of the product-packaging "pair", in other words at the upstream part of the process, which is also true for logistics/ SCM competencies and skills. However, these latter are also mobilized when delivering LFP-specific performance, covering more tactical or operational dimensions. More generally, competencies and skills appear as key concepts

within several strategic management theories (Prévot, Brulhart, & Guieu, 2010), including resource-based theory, strategic management of capabilities, knowledge-based view, dynamic capabilities and the relational view. Interrelated and complementary (Prévot, Brulhart, & Guieu, 2010), these five perspectives display some particularities and nuances; their adequate assemblage seems particularly promising for SCM research issues mostly characterized by their dynamic, relational and collaborative nature.

It is true that skills and logistics competencies - relevant for SCM - have been identified by academics (Duong & Paché, 2015), but generally without explicitly referring to neither the packaging nor the circular economy elements. Gammelgaard and Larson (2001) distinguish between general skills (context-independent) and competencies (based upon experience, unique and related to a specific context). These authors identify empirically those skills and competencies that are most important within SCM, by confronting quantitative surveys following a double perception (practitioners/ students) with qualitative research *via* case studies. Thanks to this methodological triangulation they elaborate a quasi-exhaustive inventory. Measured elements refer to the following dimensions: technical, IT, statistical, general/ management-related, intra-company and inter-companies, systemic-holistic (“*the big picture*”), communicative, ethical and human (empathy and attention).

Skills apply to both intra-company and inter-companies levels, these latter showing a deliberately strategic scope, because they are “socially complex, causally ambiguous and historically grown” (Gold, Seuring, & Beske, 2010), in other words resulting from interactions between organizations. This collaborative paradigm characterizing supply chains considers indeed strategic collaboration as a main competitive factor. From now on it also covers ecological and social aspects (Vachon & Klassen, 2006), and particularly those research issues located at the SCM/ circular economy interface. No empirical validation has been carried out so far with regards to logistics/ SCM competencies increasing the performance of circular economy-specific LFP elements, even if researchers unanimously approve the importance of inter-companies skills, located at each supply chain actor’s stage (traditional, new, private and public actors). In view of this, we propose a research model for a packaging scorecard adapted to a circular economy perspective (see Fig. 3).

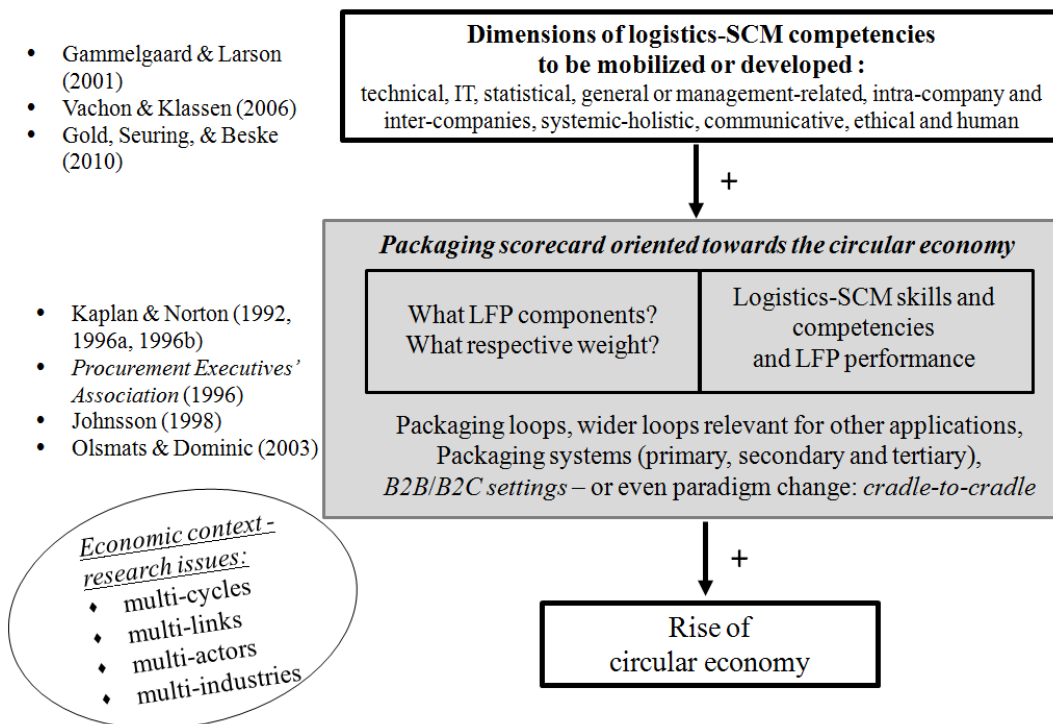


Fig. 3. Research model for a packaging scorecard adopting a circular economy perspective.

5. Conclusion

Our research strives for identifying the main components of logistics functions of packaging (LFP) fostering the transition towards a circular economy. It also intends to detect logistics skills and competencies to mobilize in order to increase LFP components' performance. Including the question of logistics skills and competencies enables to provide a bridge between the operational and the strategic spheres of our packaging performance research issue. The search for a validation field and a related measuring instrument rapidly approached extant packaging scorecards, both within the academic and the professional domains. It is true that these traditional scorecards are already packaging-specific and capture correctly the strategic scope of SCM performance, the holistic nature of any supply chain meriting this appellation and the satisfaction of the final customer. But they fail when it comes to transforming a linear economy into a circular one, in spite of claims concerning this matter of an ever increasing number of stakeholders, amongst them - the consumer. Available scorecards indeed do not consider (sufficiently) multi-cycles, multi-links, multi-actors and multi-industries characteristics, which however is immanent to the notion of circular economy.

This lack within extant literature has motivated our research, laying the foundations of a packaging scorecard that strives for an integration of "LFP performance" and "transition towards a circular economy", rather than considering these elements as contradicting goals according to the traditional view. Consequently and when adopting a wider perspective, not only the packaging scorecard has been revisited, but also the performance notion, key variable of any researcher and practitioner in (supply chain) management. We can argue in the same manner with regards to the consumer's role that has undoubtedly been strengthened as first/ last logistics link, as soon as circular economy appears on the scene.

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