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Enabling competitiveness in home-delivery through sustainable packaging logistics

Nathalie Silva and Fredrik Nilsson
Department of Design Sciences, Centre for Retail and Logistics (REAL), Lund University, Lund, Sweden

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Abstract

Purpose – The purpose of this research is to examine the role of logistics and packaging in home-delivery of food and groceries and identify opportunities for sustainable packaging logistics innovations that can enable competitive advantages for retail actors.

Design/methodology/approach – This research is based on a case study of a novel home-delivery concept for food and groceries, together with a structured literature review on recent literature. Building on the key findings from the case study and the literature review, the Resource-Advantage theory is used for knowledge development and formulation of research propositions.

Findings – This study identified a clear gap in the literature on the integration of logistics and packaging in home-deliveries while the case study revealed potentials of packaging logistics in home-delivery settings. For retail actors, it is argued that packaging logistics can enhance competitiveness of e-commerce by increasing efficiency and effectiveness and reducing environmental impact.

Research limitations/implications – The concept of packaging logistics should be investigated and tested to create opportunities for innovation and sustainability in home-deliveries, and thus aligning with the expectations and external pressures from policymakers and market to operate on sustainable grounds. Four propositions for the integration of packaging into logistics challenges to drive innovation and gain sustainability in home-deliveries are formulated.

Originality/value – Existing research on sustainable packaging logistics innovations in home-delivery operations is limited. The propositions provide areas for theory advancements and practical improvements of efficiency, effectiveness and sustainability in the context of retail and distribution.

Keywords Competitive advantage, Last-mile delivery, Innovation, Logistics, Packaging, Sustainability

Paper type Research paper

1. Introduction

Home-deliveries in general, and particularly for food and groceries, have emerged as a prevalent trend and are expected to continue expanding (McKinsey, 2024; Pelet *et al.*, 2023; Statista, 2024). Home-delivery is a term that comes under last-mile delivery, – defined by Lim *et al.* (2018, p. 310) as "*the last stretch of a business-to-consumer (B2C) parcel delivery service. It takes place from the order penetration point to the final consignee's preferred destination point.*" Last mile delivery is known to be, not only, the costliest part in logistics (Vanelslander *et al.*, 2013) but also the most environmentally impactful part of the supply chain (Ranieri *et al.*, 2018).

In the retail sector, the growth of e-commerce drives the need for change in the omni-channel landscape. The increasing demands from consumers and policymakers for sustainable development (Vadakkepatt *et al.*, 2021), make innovation and sustainability two central aspects (Gil-Saura *et al.*, 2023). Thus, providing competitive delivery solutions that are

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sustainable and offer high customer service is as critical as it is challenging (Melkonyan *et al.*, 2020). The challenges range from strict delivery requirements related to food safety (Göransson *et al.*, 2018), handling of small orders and frequent supply, door-to-door distribution, rapid and timely deliveries (Pelet *et al.*, 2023), customer convenience and the need for careful handling and sufficient protection to keep quality, safety and freshness of products. To ensure protection, containment, convenience and information for retail actors and consumers throughout the delivery processes, packaging plays a critical role (Olsson and Larsson, 2009). At the same time, packaging in e-commerce represents an environmental burden, and it accounts for the vast increase of household waste (Hao, 2021). Recent regulations are putting pressure on retailers and affecting their decision-making process. For example, the introduction of zero-emission zones in cities and the new EU Packaging and Packaging Waste Regulation (PPWR) for minimising waste packaging (European Commission, 2022).

For retail actors in e-commerce to remain competitive and be more sustainable, innovative solutions in logistics and packaging are necessary. Resource-Advantage theory (R-A theory) emphasises the impact of resources, and the way there are used in enabling a firm to run efficiently and effectively (Hunt, 1995). The drive for efficiency and effectiveness results in the creation of "productivity-enhancing innovations", which, in turn, leads to "increases in capital, technological progress, and economic growth" (Hunt, 2011, p. 14). Actors that innovate and implement strategic differentiators in their key resources tend to be more competitive and expand their market share (Hunt and Davis, 2008). Given that logistics and packaging are two key resources that drive costs and environmental impacts in e-commerce, the potential for gaining a competitive edge in these areas can be quite significant.

The purpose of this research is to examine the role of logistics and packaging in home-delivery of food and groceries, and to identify opportunities for sustainable packaging logistics innovations that can enable competitive advantages for retail actors.

Our research highlights a significant gap in understanding the integration of packaging and logistics perspectives. The literature review identified a theoretical gap, which the case study further explored from a practical standpoint. Furthermore, our case study shows that the integration of logistics and packaging resources in home-delivery of food and groceries is prospective in creating a superior resource (Hunt and Davis, 2008) for retail actors. Drawing upon Resource-Advantage theory, the article presents four research propositions that represent research venues to advance theory and practice in retail and distribution.

2. Theoretical framing

2.1 Resource-advantage theory

Originating from the marketing discipline, the R-A theory asserts that companies that deploy valuable resources more effectively can gain competitive advantage in the market. In contrast to the Neoclassical perspective, the R-A theory upholds that human motivation is not self-interest maximisation and that consumers', owners' and managers' decisions are also impacted by their sense of ethics (Hunt, 1995). Even though being environmentally sustainable can represent extra costs, implementing more sustainable business models can mitigate risks (Pires *et al.*, 2024), enable competitive advantage (Gil-Saura *et al.*, 2023) and increase market share by, for example, adding value through superior service for customers. The R-A theory brings forth the relationship between resources and competitive advantage and the stage to superior financial performance (Griffith and Yalcinkaya, 2010).

The R-A theory emphasises the potential of (tangible and intangible) resources to enhance competitiveness in a firm. The firm is not perceived as a detached entity but rather as a business operating in collaboration with other entities (Hunt and Morgan, 1996) and, thus, impacted by "societal resources, societal institutions, actions of competitors and suppliers, behaviours of consumers, and public policy decisions" (Griffith and Yalcinkaya, 2010, p. 14). More recent developments of the R-A theory have put specific focus on contextual resources. For example,

Varadarajan (2023) applies the theory to the context of physical and digital marketplaces and explores market-based resources related to customer information and knowledge to assess its impact on market performance followed by competitiveness. In their study of small family grocers, Srichookiat and Jindabot (2017) apply the R-A theory and identify key resources as the establishment of personal relationships with customers, which enables a competitive advantage over chain retailers.

Innovations and new sustainability practices can be a strategic approach to developing superior resources (Hunt and Davis, 2008), enabling businesses to differentiate their services from competitors by leveraging relative cost efficiency and/or value effectiveness. As logistics and packaging are critical resources for retail actors, integrating them into innovative solutions can represent potential superior resource in the context of e-commerce.

2.2 Packaging logistics

In the context of home-deliveries of food and groceries, the logistics and the packaging systems are the key resources that connect the retailer to the customer (order fulfilment) (Figure 1). For this study, the boundaries for the logistics system were constricted to the logistics activities from the retail warehouse to the home-delivery of products (including reverse flows). The packaging system is defined as a multi-level system (Hellström and Saghir, 2007) with primary packaging (the closest to the product), secondary packaging (contains several primary packages) and tertiary packaging (contains several secondary packages).

Packaging has been attracting increased attention in logistics systems and supply chains (Silva and Pålsson, 2022), with a pivotal role to optimise the overall performance (García-Arca *et al.*, 2014; Kye *et al.*, 2013). Focusing on minimising the material usage of packaging may create negative implications, such as increase of food waste, as the environmental impact of packaging is typically in the range of 5–25% in relation to the products it protects (Williams and Wikström, 2011). Therefore, in the design of a packaging system the aim should be to optimise, not minimise, material usage. An integrated approach of packaging design with the logistics demands brings forward a set of possibilities to optimise assets and material usage. Nonetheless, research is still largely overlooking the role of packaging in home-deliveries. For example, in recent retail and distribution studies packaging is not considered as a factor influencing the delivery and convenience for consumers nor for other retail actors in their operations platforms (e.g. Pelet *et al.*, 2023; Zhao *et al.*, 2023).

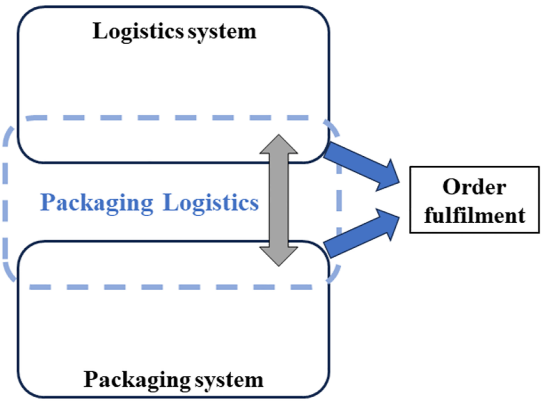

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Figure 1. Packaging logistics – integration of packaging and logistics systems, and the relation of it to order fulfilment for the customer

The potential for such innovations goes beyond considering packaging and logistics as separate systems, but from having an integrated perspective of the two. From this notion, research has proven the concept of packaging logistics (Hellström and Saghir, 2007) to affect efficiency and effectiveness (Jahre and Hatteland, 2004), innovation (Hellström and Saghir, 2007) as well as sustainability and circularity (Lindh *et al.*, 2016; Silva and Pålsson, 2022).

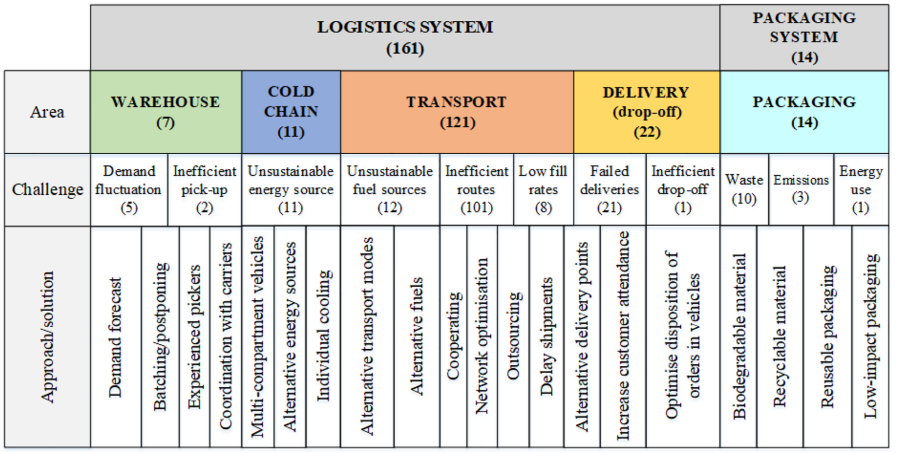
3. Literature review

To understand the landscape of research and state-of-art knowledge in home-deliveries of food and groceries, a literature review of the recent literature was conducted to identify the areas, challenges and solutions/approaches. These results were important in understanding the context and the discourse in home-deliveries regarding both key resources and related to the competitive landscape of e-commerce. Based on the intriguing finding that logistics and packaging are not being discussed jointly or integrated, an in-depth analysis was made on the minor sub-sample of articles that do mention or include logistics and packaging in the same study.

3.1 Areas, challenges and approaches/solutions

The content analysis of the 175 articles resulted in five research areas being identified for home delivery of food and groceries (see Figure 2). The area of *Transport* (121 articles) being dominant in number of articles followed by *Delivery (drop-off)* (22 articles), *Cold chain* (11 articles) and *Warehouse* (7 articles) related to the logistics system and *Packaging* (14 articles) related to the packaging system.

Regarding the identified challenges, inefficient routes (under Transport) draw most of the research attention (101 research articles), significantly higher than the second most discussed challenge of failed deliveries (21 research articles). Thus, various ways to optimise delivery routes are the dominant approach for home delivery of food and groceries. The remaining challenges attract relatively less attention even though they can significantly affect, virtually, every e-commerce fulfilment activity.



Note(s): The numbers in brackets represent the number of articles falling in each of the systems, areas, and challenges

Source(s): Authors' own work

Figure 2. Distribution of the sampled articles within the areas, and the mapping of the challenges and approaches/solutions discussed in the articles

Figure 2 also shows that packaging is studied independently from logistics, as there are no overlaps identified between the approaches/solutions proposed for the logistics system's challenges nor for the packaging system's challenges. The challenges found in the literature under the packaging system relate to the direct impact of packaging (i.e. material and design) overlooking the impacts on the logistics system. Similarly, the literature tends to ignore the role and importance of packaging challenges in the logistics system.

3.2 Logistics and packaging interactions

Delving into the connection between the logistics and the packaging systems, an in-depth analysis was carried out on the articles that considered both packaging and logistics (Figure 3). From the 14 articles under the *packaging system*, only two of them also included and evaluated logistics in the analysis. Similarly, of the 161 articles categorized under the logistics system, only 16 addressed packaging, often briefly, with this being especially evident in the studies related to *Transport*. Even though both packaging and logistics were considered simultaneously in 18 articles, the integrated concept of packaging logistics is not recognised or discussed in none of them. These findings were surprising, as both logistics and packaging are critical in home-delivery but are studied as separate and independent entities.

	LOGISTICS SYSTEM (161)								PACKAGING SYSTEM (14)		
Area	WAREHOUSE (7)		COLD CHAIN (11)	TRANSPORT (121)			DELIVERY (drop-off) (22)		PACKAGING (14)		
Challenge	Demand fluctuation (5)	Inefficient pick-up (2)	Unsustainable energy source (11)	Unsustainable fuel sources (12)	Inefficient routes (101)	Low fill rates (8)	Failed deliveries (21)	Inefficient drop-off (1)	Waste (10)	Emissions (3)	Energy use (1)
Packaging *AND* Logistics	2	0	4	2	5	2	0	1	1	0	1

Source(s): Authors' own work

Figure 3. Distribution of the sampled articles that considered packaging *and* logistics

4. Method

This research was prompted by a research project (2022–2024) involving an e-commerce business unit (in this paper denoted as "e-tailer") of a Swedish retail company of food and groceries. Based on new regulations on home-deliveries (zero-emission free zones in cities), new regulations of packaging (e.g. PPWR) and increased environmental awareness of consumers, the project took off by investigating logistics concepts for more efficient and sustainable home-deliveries. The e-tailer was once a pioneer in the area, but due to increased competition had lost its market leadership. A case study was carried out based on the unique situation of the e-tailer, to explore packaging logistics concepts as a specific resource to efficiently and effectively provide superior value to its customers and regain its competitive advantage. A literature review was conducted in parallel, from which key challenges in home-delivery, along with logistics and packaging-related approaches and solutions reported in the literature.

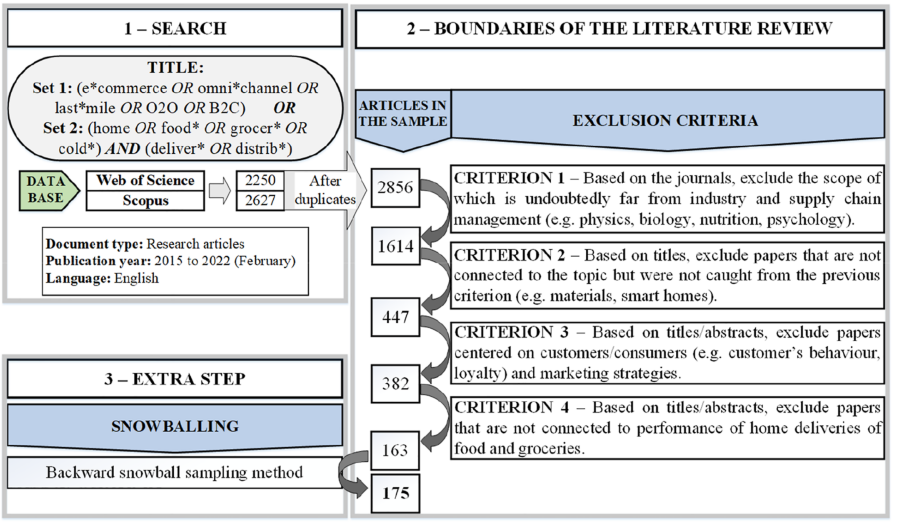
Based on the findings from the case study and the research gap identified in the literature review, the R-A theory was used for theoretical reasoning and development. Building on the fact that logistics and packaging are two critical resources in the home-delivery of food and groceries, theory development was carried out regarding the potentials of implementing a

packaging logistics perspective for sustainability-oriented innovations to increase competitiveness in the market for e-commerce businesses in the food and grocery setting. Within the framing of the R-A theory, four research propositions were developed to explore opportunities for improving efficiency, sustainability and creating value in home-deliveries. These propositions aim to serve as strategic differentiators with the potential to provide competitive advantages for retail actors in their e-commerce businesses and for research to further examine.

4.1 Literature review

A literature review, based on the guidelines by Tranfield *et al.* (2003), was carried out to understand the landscape of research in home-deliveries of food and groceries, and specifically to identify the challenges and solutions/approaches discussed in the literature. For the search, the titles were scanned using two sets of terms: (1) a set with the terms frequently used in the literature (*e*commerce* OR *omni*channel* OR *last*mile* OR *O2O* OR *B2C)*, and (2) a set with two more general subsets that combined (using operator AND) covering relevant research that would not be caught with the first set of terms: (*home* OR *food** OR *grocer** OR *cold**) and (*deliver** OR *distribut**). The search terms used were purposefully broad for a "neutral" stance on the literature. Articles that did not show relevance for last mile delivery and focused on entities upstream in the supply chain (e.g. manufacturers/producers) or other considerations that are not encompassed in this study (e.g. food waste) were not part of the scope, and were therefore, excluded. The search yielded 163 relevant articles to the context of home-deliveries of food and groceries, which were then complemented with 12 more articles from the backward snowballing sampling method, resulting in a final sample of 175 articles (Figure 4).

Content analysis was conducted for each of the 175 articles and categorised in three levels of categories: areas, challenges and approaches/solutions. In this process, the first step was to identify the challenge that each paper was addressing. From there it was possible to deduce the area, which refers to the supply chain process in which the challenge arises. The approaches/solutions were based on the contribution of each paper and were aligned to the area and challenge identified before. Adjustments were needed in the process with constant discussion



Source(s): Authors' own work

Figure 4. Search and sorting of the literature review-based articles

between the authors to ensure robustness in the results, particularly when clustering the approaches/solutions.

After several rounds, saturation was reached, and the sample of articles was coded (Figure 2). Once the state of the art was organised, the analysis aimed to understand the role that packaging plays in the logistics challenges and vice-versa. The articles that considered both packaging *and* logistics systems were considered for further analysis.

4.2 Case study

The case study centres around events from a firm level perspective and the exploration and investigation of these contemporary events of which the researchers have little control in a unique setting (Yin, 2014). Besides the e-tailer of food and groceries, the participants included a global packaging company, a logistics service provider (LSP), two information technology (IT) providers, a research cluster organisation and a university. During a period of 8 months, the home-delivery concept was developed through a design science approach (Holmström *et al.*, 2009), which included multiple iterations of circular packaging protypes, choice of transport modes, development of new processes and conceptual evaluations before a testable concept emerged [1]. During regular, bi-weekly meetings, the project parties discussed concerns on the requirements and impacts of such a solution for the actors involved. In total, the corporate participants spent more than 500 h of work in designing, testing, discussing and operationally working with and evaluating the home-delivery concept for groceries.

The home-delivery concept under study involved delivering groceries using a reusable, insulated, biomaterial-based box in a non-refrigerated electric van to customer homes. This approach aimed to reduce packaging waste and maintain a cold chain without active cooling, minimising energy consumption. The development of the home-delivery concept went through several iterations to match the process and quality requirements identified, that is packability, robustness, stackability, protection, temperature, customer convenience and ease of handling. The concept required customer involvement, as they were asked to handle and keep the box for one week and return it to the driver upon next delivery. To ensure quality and safety, a sensor was added inside the box to measure the temperature from the filling of the box until delivered to customer.

To test the feasibility of the home-delivery concept, a field-test was carried out. The field-test included eight customers who, received a delivery of chilled groceries each Sunday over a period of four weeks. In total, 36 deliveries of chilled groceries and pick-ups of returnable boxes were made. During this field-test feedback from the warehouse staff and delivery drivers were collected via interviews and observations (5 interviews and 3 observations of the whole delivery process to all customers, lasting 3–4 h). All customers were interviewed two times: after the second delivery (return of first box) and one week after the final delivery. Customers were asked a set of open questions on their overall impressions followed by specific questions related to the delivery and returnable box. Notes were taken during the interviews and shared directly in the research team. Before and during the field-test, weekly/bi-weekly meetings were held among the project participants to plan and execute the field-test and two workshops were held afterwards to analyse and synthesise the collected data. In parallel, the research team from the university conducted individual follow-up interviews with the e-tailer managers, the packaging supplier and the LSP.

5. Findings

The findings from literature review put forward logistics and packaging to be critical resources in home-delivery of food and groceries as both are potential strategic differentiators for retail actors in e-commerce. However, logistics and packaging are predominately researched and studied as separate entities and not evaluated or promoted as integrated in the approaches and solutions presented. We found this surprising, as logistics and packaging clearly affects each other in the home-delivery of products.

The case study showed that the home-delivery concept could have potential to meet the environmental ambitions and was recognised by the customers to be a superior experience. However, customer concerns regarding the handling of the box and the major changes (and investments) needed to implement new processes. The current production and warehouse were designed for a one-way flow, and the involvement of reusable boxes and return flows required new practices and new routines. A key measurement, related to cost and sustainability, was the reusability of the box. The result from the field test revealed that after two-three reuse rounds, 58 out of 60 boxes were in good shape and met the requirements to be reused.

The *customers* acknowledged that with the new box, the products were better distributed and better protected compared to the single-use paper bags provided before and by competitors. Some customers acknowledged the possibility of being delivered unattended deliveries since the box kept the groceries cold. Their main concern was the inconvenience from storing the "bulky" box for a week. Customer suggestions were to directly empty the box and return it or to drop it in nearby retail outlets.

The handling and packing of groceries were found to be agile by the *warehouse staff*, however the new reverse logistics processes were somehow challenging. Inspection and cleaning, as well as storage in the warehouse required more time and adjustments. The fact that the adjustments for the circular setting were made "on top of" the linear setting made the operations in the warehouse difficult. From the *LSP drivers' feedback*, boxes were easier to carry from the van to the doorstep as the box had good handles and good distribution of the weight. Emphasis was placed on the environmental benefits of eliminating refrigerated vans and the potential cost savings and flexibility of using standard vans. The drivers were also satisfied with how promptly customers returned the empty boxes.

The *e-tailer managers* recognised that the concept provided the sustainability requirements of less energy for the deliveries and the potential to reduce packaging waste. Nonetheless, it was found difficult to continue implementing it due to (1) the major changes needed in the current production/warehouse to operationally scale it up; and (2) the inconvenience raised by some customers from having to store the box. In the current warehousing setting, limited space and staff to accommodate the new processes for inspection, cleaning of boxes and storage were found to be operationally and economically challenging. For the e-tailer, cost-efficiency in their own operations is key. Changing to the new delivery concept would require investments and the movement of their operations to a more suitable facility.

When addressing the identified barriers in follow-up meetings, several improvement points were identified. Some key design insights for the box (a protective layer in the bottom and a foldable solution), the estimation of the reusability of the box was set to be between five to eight iterations. For customers, sharing more information and consider monetary incentives for the box handling, as well as possibilities to return the box at nearby retail outlet, were some of the possibilities to be explored. At the e-tailer, the process challenges were identified as structural that needed a strategic change and financial investment. Building on a linear system to achieve a circular set-up revealed shortcomings at the e-tailer and was found to be the main barrier. Similar insights were provided by the packaging company, with its core business selling single-use packaging solutions, on how they could provide new services, that is packaging as a service, to retail actors in e-commerce to enable the use of circular packaging solutions.

A key project insight was that shifting e-tailer operations from linear to circular deliveries required interrelated changes, strategic planning and investment. Given the strategic approach, it was concluded that the new delivery concept of reusable boxes in non-refrigerated deliveries was a prospective differentiator in the market.

6. Discussion – competitive advantage from a packaging logistics perspective

To address the research gap identified in the literature review and the case study, we propose four research streams to advance the understanding of the potential role of packaging in

tackling logistics challenges in home-deliveries. These propositions are presented and discussed for theory refinement and further knowledge development by contextualising the R-A theory with the key resources of packaging and logistics as enablers for innovation and sustainability in retail and distribution. They also serve as testable ideas for empirical validation in real-world contexts. These propositions pave the way for new directions to be considered by retail actors as a set of possibilities to get differentiated from the competition by creating more added value to their services and business models.

6.1 Circular packaging logistics to increase sustainability in home-deliveries

Research in home-deliveries has greatly focused on optimising delivery routes and reverse logistics for incorrect orders or faulty products; however, reusable packaging has high potential in home-deliveries due to the geographically bounded delivery areas. Camps-Posino *et al.* (2021) showed that replacing single-use with reusable packaging for food deliveries in China, could reduce up to 63% of the current emissions. Despite its potential and growing interest, there are barriers to its implementation and up-scaling, particularly due to "the current packaging value chain, mainly linked to a lack of acceptance, a lack of infrastructure" as well as "product safety, and cost" (McKinsey, 2023, p. 2). Similar barriers are found in our case study, and the need for investments and a strategic circular approach identified for further development.

Since food packaging requires rigorous safety and hygiene measures, inspection and cleaning are crucial, adding complexity and cost. For viability, however, new set-ups must be designed based on circular principles and not merely added on existing linear ones. The linear set-up was, in our case study, found to be the major reason for not implementing the concept further, while the home-delivery concept met environmental and new value-added services. This proposition brings packaging and logistics together by exploring the potential of improving the environmental aspects of packaging logistics as well as the efficiency in the areas of *warehouse* and *transport.*

Proposition 1. Implementing circular and reusable packaging systems in home-deliveries of food and groceries optimises the use of material resources and aligns with a circular economy, which, in turn, leads to a competitive advantage.

6.2 Packaging logistics to reduce dependence on refrigerated vehicles

Although some studies have explored how packaging can be designed with insulation to reduce dependency on refrigerated vehicles (e.g. Chaitanoo *et al.*, 2020), the broader impact of such innovations on the logistics system efficiency remains under-researched. Further investigation is needed to explore its potential, particularly the ability of insulating properties to extend the orders' cooling time. This is especially relevant given the low thermal efficiency of conventional cooling systems (e.g. diesel-powered refrigeration systems typically achieve around 40% thermal efficiency (Du *et al.*, 2020)), which contributes to the high costs of cold chains. Additionally, with parcel lockers in e-commerce currently unsuitable for food and groceries, insulated packaging offers a promising solution by extending the period during which products remain protected and stable (e.g. maintaining optimal temperature and humidity). As identified and tested in the case study, the possibility of leaving groceries unattended at the doorstep with controlled temperature, would increase delivery flexibility and efficiency.

With time being the most important aspect of home-deliveries (Pelet *et al.*, 2023), the use of insulated packaging enables more flexible deliveries. The added flexibility in this case can be of interest for customers (as reported in the feedback from the case study) and for the e-commerce actors, reducing the risks of failed deliveries. As found in the case study, it also enables flexibility in vehicles being used since they do not have to be refrigerated. This proposition brings packaging and logistics together by exploring the potential of integrating

packaging to improve the efficiency in the areas of *cold chain*, *transport* and *delivery (drop-off).*

Proposition 2. The use of temperature-controlled packaging reduces the need for refrigerated vehicles and enables unattended deliveries at the doorstep, trough parcel lockers or reception boxes. This minimises energy usage and increases delivery efficiency, which, in turn, leads to a competitive advantage.

6.3 Packaging design to increase last mile efficiency and new value-added services for customers

One of the main functions of packaging is protection, which means that, because of the less careful handling and transport, the orders may require more packaging to ensure quality of the product. When there is insufficient coordination between logistics and packaging managers two phenomena can occur: packaging solutions designed with minimal material and thus, limited protection (underpackaging (Nilsson *et al.*, 2013)) or packaging solutions with "excessive" material (overpackaging (Lin, 2022)). Both have negative consequences and lead to increased costs and a larger environmental footprint without necessarily translating into higher customers' satisfaction (Chueamuangphan *et al.*, 2020).

An integrated packaging design brings forward a set of possibilities to optimise resources used in last-mile logistics. Integrating packaging in logistics' challenges can be a move to increase transport efficiency. It can mitigate the risks of damaged products from mechanical impacts as well as enable more ergonomic handling for the delivery personnel. These key points emerged from the case study, with drivers highlighting improved ergonomics raised and customers noting that the products were better protected and not stacked on top of each other. This can have positive effects on costs and emissions and on order fulfilment (with less returns and complaints) and reduce the need for extra transport. Such moves can enable the possibility of using smaller vehicles or reducing the fleet as a result from a better fill rate utilisation (García-Arca *et al.*, 2015) without impacting the service level.

It can have positive effects on costs and emissions and on order fulfilment (with less returns and complaints) and thus reduce the need for extra transport. Such moves can enable the possibility of using smaller vehicles or reducing the fleet as a result from a better fill rate utilisation (García-Arca *et al.*, 2015) without impacting the service level.

Finally, for groceries, most packages are still designed for brick-and-mortar retail rather than for e-commerce, meaning they are sized and designed for high visibility on a physical shelf. With the interface of webpages and with home-delivery of the groceries, new packaging designs, sizes and functions can be developed to be more tailored to different customer segments in the market. Hence, with new packaging designs for e-commerce, value-added features to consumers can be added (customised sizes), reusable containers, pouches for refills, etc. as well as more suitable delivery set-ups. Sharda *et al.* (2024) present the case of Hellofresh, a company that has developed customised packaging solutions for their home-delivery of meal-kits. This proposition brings packaging and logistics together by exploring the potential of integrating packaging to improve the efficiency in the areas of *transport* and *delivery (drop-off),* but also in terms of increased customer satisfaction.

Proposition 3. Integrating packaging design with logistics processes and distribution channels enhances logistics efficiency, reduces environmental impacts and provides value-added services for customers which, in turn, leads to a competitive advantage.

6.4 Collaboration to reduce packaging

The challenge of inefficient routes was identified as the most researched challenge in the literature review (Section 3). Horizontal cooperation among delivery actors and outsourcing of

logistics services were reported as approaches/solutions to this challenge. However, the potential from cooperation among retail actors on standardised packaging (especially secondary and tertiary levels) was not discussed, as it can enhance the "revenue sharing and cost sharing contracts enable supply chains to achieve coordination while reducing packaging" and the "strategy of reducing packaging can help the supply chain increase profits" (Zhao and Song, 2023, p. 6264). For example, Svenska Retursystem (www.retursystem.se/en) represents a successful nationwide return system for crates and pallets (including six types of crates and two types of pallets), resulting from a collaboration initiative among producers and retailers. Today it features around 19 million load carriers that are washed, stored and distributed from highly automated facilities and used in up to 60% of all flows of food and groceries in Sweden. The company's services include collaborations with food producers and retail actors, focusing on high efficiency, simplicity and improved environmental performance. In the case study, the packaging company gained insights on developing not only insulated biobased packaging, but also new market offers of providing actors with packaging as a service, something that could lower the cost and operational handling for e-commerce actors as well as increase resource efficiency.

For high demand areas, volume efficiency can be particularly important, as the vehicle capacity is oftentimes what hinders the number of orders loaded, which triggers the need for more vehicles to cover relatively small areas. Fewer vehicles also lead to less traffic and better city and urban logistics (Kang and Pang, 2022). Reducing the packaging assortment in the market also enables increased flexibility for reverse logistics and enables the open-loop concept of packaging in line with the circular economy paradigm (Batista *et al.*, 2018). By reducing the variety of packaging alternatives in the market, volume efficiency can also be improved. This proposition brings packaging and logistics together by exploring the potential of integrating packaging to improve the efficiency in the areas of *warehouse* and *transport*.

Proposition 4. Collaboration between retail actors (both vertically and horizontally) reduces packaging assortment and complexity, and improves logistics flexibility and efficiency, which, in turn, leads to a competitive advantage.

7. Concluding remarks

This research identified a clear gap in the recently published literature on the integration of logistics and packaging for home-delivery of food and groceries. The case study shows potentials for increased sustainability and innovations on packaging logistics. Hence, by acknowledging logistics and packaging as critical resources and integrating them, retail actors can leverage their businesses by offering delivery services with superior value to customers in their home-delivery segment.

Building on the research results, this paper provides four research propositions for sustainability-oriented innovations in the home-delivery of food and groceries based on a packaging logistics perspective. With an R-A theory lens, the propositions provide avenues for improved efficiency, customer value and sustainability, which, in turn, could enable a competitive advantage. Thus, the concept of packaging logistics in this context should be further investigated and tested to advance knowledge to create more opportunities for innovation and sustainability, and thus converging with the expectations from external pressures from policymakers and market for retail actors to operate on more sustainable grounds.

The search was limited by both the timeframe and keywords, restricting the selection of relevant literature. A broader timeframe could have provided a more comprehensive sample. Regarding the case study, carried out in Stockholm, Sweden, can be seen as a limitation and not representative due to being a context that is different from many other cities in the world as well as more rural settings. However, for the purpose of exploring and gaining key learnings from a unique approach to home-deliveries and closeness to the actors involved, it still

provides valuable insights and key learnings to advance knowledge of retail and distribution management research.

Notes

1. Information and results from the design science research study can be found in Silva and Nilsson (2024).

References

Batista, L., Bourlakis, M., Smart, P. and Maull, R. (2018), "In search of a circular supply chain archetype – a content-analysis-based literature review", *Production Planning and Control*, Vol. 29 No. 6, pp. 438-451, doi: 10.1080/09537287.2017.1343502.

Camps-Posino, L., Batlle-Bayer, L., Bala, A., Song, G., Qian, H., Aldaco, R., Xifré, R. and Fullana-i-Palmer, P. (2021), "Potential climate benefits of reusable packaging in food delivery services. A Chinese case study", *Science of The Total Environment*, Vol. 794, 148570, doi: 10.1016/j.scitotenv.2021.148570.

Chaitanoo, N., Ongkunaruk, P. and Leingpibul, D. (2020), "The use of physical simulation to evaluate thermal properties of food containers in cold chain logistics", *IOP Conference Series: Materials Science and Engineering*, Vol. 773 No. 1, 012018, doi: 10.1088/1757-899X/773/1/012018.

Chueamuangphan, K., Kashyap, P. and Visvanathan, C. (2020), "Packaging waste from E-commerce: consumers' awareness and concern", in Ghosh, S.K. (Ed.), *Sustainable Waste Management: Policies and Case Studies*, Springer, Singapore, pp. 27-41, doi: 10.1007/978-981-13-7071-7_3.

Du, J., Nie, B., Zhang, Y., Du, Z., Wang, L and Ding, Y. (2020), "Cooling performance of a thermal energy storage-based portable box for cold chain applications", *Journal of Energy Storage*, Vol. 28, 101238, doi: 10.1016/j.est.2020.101238.

European Commission (2022), "Packaging: council and Parliament strike a deal to make packaging more sustainable and reduce packaging waste in the EU", [WWW Document], Consilium, available at: https://www.consilium.europa.eu/en/press/press-releases/2024/03/04/packaging-council-and-parliament-strike-a-deal-to-make-packaging-more-sustainable-and-reduce-packaging-waste-in-the-eu

García-Arca, J., Prado-Prado, J. and Gonzalez-Portela Garrido, A. (2014), "'Packaging logistics': promoting sustainable efficiency in supply chains", *International Journal of Physical Distribution and Logistics*, Vol. 44 No. 4, pp. 325-346, doi: 10.1108/IJPDLM-05-2013-0112.

García-Arca, J., Prado-Prado, J. and Garrido, A.T.G.-P. (2015), "Drivers and stages in 'packaging logistics': an analysis in the food sector", in Cortés, P., Maeso-González, E. and Escudero-Santana, A. (Eds), *Enhancing Synergies in a Collaborative Environment*, Springer International Publishing, pp. 51-59, doi: 10.1007/978-3-319-14078-0_6.

Gil-Saura, I., Ruiz-Molina, M., Marín-García, A. and Michel, G. (2023), "Sustainability-oriented commerce innovation: how does it influence consumer satisfaction?", *International Journal of Retail and Distribution Management*, Vol. 51 No. 11, pp. 1477-1496, doi: 10.1108/IJRDM-07-2022-0267.

Göransson, M., Nilsson, F. and Jevinger, Å. (2018), "Temperature performance and food shelf-life accuracy in cold food supply chains – insights from multiple field studies", *Food Control*, Vol. 86, pp. 332-341, doi: 10.1016/j.foodcont.2017.10.029.

Griffith, D. and Yalcinkaya, G. (2010), "Resource-advantage theory: a foundation for new insights into global advertising research", *International Journal of Advertising*, Vol. 29 No. 1, pp. 15-36, doi: 10.2501/S0265048709201014.

Hao, Z. (2021), "Analysis on pollution hazards and recycling strategies of logistics packaging wastes of E-commerce enterprises", *Nature Environment and Pollution Technology*, Vol. 20 No. 3, pp. 1209-1216, doi: 10.46488/NEPT.2021.v20i03.029.

Hellström, D. and Saghir, M. (2007), "Packaging and logistics interactions in retail supply chains", *Packaging Technology and Science*, Vol. 20 No. 3, pp. 197-216, doi: 10.1002/pts.754.

Holmström, J., Ketokivi, M. and Hameri, A. (2009), "Bridging practice and theory: a design science", *Decision Sciences*, Vol. 40 No. 1, pp. 65-87, doi: 10.1111/j.1540-5915.2008.00221.x.

Hunt, S. (1995), "The resource-advantage theory of competition: toward explaining productivity and economic growth", *Journal of Management Inquiry*, Vol. 4 No. 4, pp. 317-332, doi: 10.1177/105649269500400403.

Hunt, S. (2011), "Sustainable marketing, equity, and economic growth: a resource-advantage, economic freedom approach", *Journal of the Academy of Marketing Science*, Vol. 39 No. 1, pp. 7-20, doi: 10.1007/s11747-010-0196-3.

Hunt, S. and Davis, D. (2008), "Grounding supply chain management in resource-advantage theory: in defense of a resource-based view of the firm", *Journal of Supply Chain Management*, Vol. 48 No. 2, pp. 14-20, doi: 10.1111/j.1745-493X.2012.03266.x.

Hunt, S. and Morgan, R. (1996), "The resource-advantage theory of competition: dynamics, path dependencies, and evolutionary dimensions", *Journal of Marketing*, Vol. 60 No. 4, pp. 107-114, available at: https://journals.sagepub.com/doi/10.1177/002224299606000410

Jahre, M. and Hatteland, C. (2004), "Packages and physical distribution: implications for integration and standardisation", *International Journal of Physical Distribution and Logistics Management*, Vol. 34 No. 2, pp. 123-139, doi: 10.1108/09600030410526923.

Kang, X. and Pang, H. (2022), "City selection for fresh produce e-commerce's market entry strategy: based on the perspective of urban logistics competitiveness", *Transportation Research Interdisciplinary Perspectives*, Vol. 13, 100537, doi: 10.1016/j.trip.2022.100537.

Kye, D., Lee, J. and Lee, K. (2013), "The perceived impact of packaging logistics on the efficiency of freight transportation (EOT)", *International Journal of Physical Distribution and Logistics Management*, Vol. 43 No. 8, pp. 707-720, doi: 10.1108/IJPDLM-08-2011-0143.

Lim, S., Jin, X. and Srai, J. (2018), "Consumer-driven e-commerce: a literature review, design framework, and research agenda on last-mile logistics models", *International Journal of Physical Distribution and Logistics*, Vol. 48 No. 3, pp. 308-332, doi: 10.1108/IJPDLM-02-2017-0081.

Lin, J. (2022), "How to reduce overpackaging of food in China: analysis based on evolutionary game", *Sustainable Production and Consumption*, Vol. 31, pp. 529-545, doi: 10.1016/j.spc.2022.03.012.

Lindh, H., Williams, H., Olsson, A. and Wikström, F. (2016), "Elucidating the indirect contributions of packaging to sustainable development: a terminology of packaging functions and features", *Packaging Technology and Science*, Vol. 29 Nos 4-5, pp. 225-246, doi: 10.1002/pts.2197.

McKinsey (2023), "The potential impact of reusable packaging", available at: https://www.mckinsey.com/industries/packaging-and-paper/our-insights/the-potential-impact-of-reusable-packaging (accessed 13 August 2023).

McKinsey (2024), "Although economic uncertainty will likely persist in 2024, grocery retailers could fuel growth by pursuing innovative offerings, investing in tech and sustainability, and attracting top talent", available at: https://www.mckinsey.com/industries/retail/our-insights/state-of-grocery-europe-2024-signs-of-hope (accessed 13 July 2024).

Melkonyan, A., Gruchmann, T., Lohmar, F., Kamath, V. and Spinler, S. (2020), "Sustainability assessment of last-mile logistics and distribution strategies: the case of local food networks", *International Journal of Production Economics*, Vol. 228, 107746, doi: 10.1016/j.ijpe.2020.107746.

Nilsson, F., Fagerlund, M. and Körner, J. (2013), "Globally standardised versus locally adapted packaging: a case study at Sony Ericsson Mobile Communications AB", *International Journal of Retail and Distribution Management*, Vol. 41 No. 5, pp. 396-414, doi: 10.1108/IJRDM-05-2013-0091.

Olsson, A. and Larsson, A. (2009), "Value creation in PSS design through product and packaging innovation processes", in Sakao, T. and Lindahl, M. (Eds), *Introduction to Product/Service-System Design*, Springer, London, pp. 93-109, doi: 10.1007/978-1-84882-909-1_5.

Pelet, J., Taieb, B. and Alkhudary, R. (2023), "Measuring consumer perceptions of home-delivery convenience – the case of cargo bikes", *International Journal of Retail and Distribution Management*, Vol. 51 Nos 9/10, pp. 1371-1387, doi: 10.1108/IJRDM-11-2022-0483.

Pires, M., Pereira, L., Carvalho, J., Silva, R., Simões, A., Silva, A. and Simões, A. (2024), "Sustainability: the new element for creating competitive advantage", *Progress in Industrial Ecology, An International Journal (PIE)*, Vol. 17 Nos 1/2, pp. 163-210, doi: 10.1504/PIE.2024.140510.

Ranieri, L., Digiesi, S., Silvestri, B. and Roccotelli, M. (2018), "A review of last mile logistics innovations in an externalities cost reduction vision", *Sustainability*, Vol. 10 No. 3, p. 782, doi: 10.3390/su10030782.

Sharda, N., Krampe, C. and Ingenbleek, P. (2024), "HelloFresh: transitioning to a plastic-free future?", *The International Food and Agribusiness Management Review*, Vol. 27 No. 2, pp. 378-396, doi: 10.22434/ifamr2023.0068.

Silva, N. and Nilsson, F. (2024), "Exploring the circular last mile: reusable packaging in home delivery of food and groceries using a design science approach", doi: 10.1080/09593969.2024.2414082.

Silva, N. and Pålsson, H. (2022), "Industrial packaging and its impact on sustainability and circular economy: a systematic literature review", *Journal of Cleaner Production*, Vol. 333, 130165, doi: 10.1016/j.jclepro.2021.130165.

Srichookiat, S. and Jindabot, T. (2017), "Small family grocers' inherent advantages over chain stores: a review", *International Journal of Retail and Distribution Management*, Vol. 45 No. 4, pp. 446-462, doi: 10.1108/IJRDM-04-2016-0050.

Statista (2024), "'Online food delivery – worldwide' | Statista market forecast", available at: https://www.statista.com/outlook/emo/online-food-delivery/worldwide (accessed 20 June 2024).

Tranfield, D., Denyer, D. and Smart, P. (2003), "Towards a methodology for developing evidence-informed management knowledge by means of systematic review", *British Journal of Management*, Vol. 14 No. 3, pp. 207-222, doi: 10.1111/1467-8551.00375.

Vadakkepatt, G., Winterich, K., Mittal, V., Zinn, W., Beitelspacher, L., Aloysius, J., Ginger, J. and Reilman, J. (2021), "Sustainable retailing", *Journal of Retailing*, Vol. 97 No. 1, pp. 62-80, doi: 10.1016/j.jretai.2020.10.008.

Vanelslander, T., Deketele, L. and Van Hove, D. (2013), "Commonly used e-commerce supply chains for fast moving consumer goods: comparison and suggestions for improvement", *International Journal of Logistics Research and Applications*, Vol. 16 No. 3, pp. 243-256, doi: 10.1080/13675567.2013.813444.

Varadarajan, R. (2023), "Resource advantage theory, resource based theory, and theory of multimarket competition: does multimarket rivalry restrain firms from leveraging resource Advantages?", *Journal of Business Research*, Vol. 160, 113713, doi: 10.1016/j.jbusres.2023.113713.

Williams, H. and Wikström, F. (2011), "Environmental impact of packaging and food losses in a life cycle perspective: a comparative analysis of five food items", *Journal of Cleaner Production*, Vol. 19 No. 1, pp. 43-48, doi: 10.1016/j.jclepro.2010.08.008.

Yin, R. (2014), *Case Study Research: Design and Methods*, SAGE, London.

Zhao, C. and Song, J. (2023), "Coordination of Supply Chain Considering consumers' green preference under reduced packaging strategy", *Journal of Industrial and Management Optimization*, Vol. 19 No. 8, pp. 21-22, doi: 10.3934/jimo.2022215.

Zhao, Y., Zhao, X. and Liu, Y. (2023), "How brick-and-mortar retailers and grocery delivery platforms influence purchase intention?", *International Journal of Retail and Distribution Management*, Vol. 51 No. 12, pp. 1677-1697, doi: 10.1108/IJRDM-02-2023-0112.

About the authors

Nathalie Silva is a PhD at the Department of Design Science, Faculty of Engineering, Lund University, Sweden. Her research is focused on packaging logistics to improve sustainability in supply chains. She has published in the *Journal of Cleaner Production* and *Resources, Conservation and Recycling* and has presented her work in several Nordic conferences. Nathalie Silva is the corresponding author and can be contacted at: nathalie.silva@plog.lth.se

Fredrik Nilsson is Professor at the Department of Design Science, Lund University, Sweden. His research areas are focused on sustainable and circular supply chains, with current projects in e-commerce, packaging and consumer goods supply chains. He has published work in the *Journal of Business Logistics*, *Journal of Cleaner Production*, *International Journal of Operations and Production Management*, *International Journal of Logistics Management* and *International Journal of Physical Distribution and Logistics Management.*