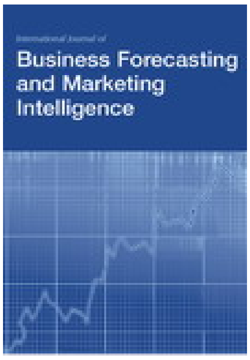

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Orchestrating a ship-from-store omnichannel operation using 4PL digital platform

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Abstract: Digitalisation has changed production and retailing with paramount and irreversible consequences. The commercialisation in physical stores is fastly migrating to online channels, so that transitional omnichannel operations need to be structured to ensure retailers competitiveness and survival. Omnichannel stock allocation policies, such as the ship-from-store (SFS), need to be evaluated considering potential impacts on customer service level.

Furthermore, a very important factor is the last mile, where the location value is finally materialised to the customer. This article aims to propose a SFS omnichannel operations model that is orchestrated by a 4PL digital platform, integrating retailing processes with transportation by third parties. Thereof, we reviewed related concepts and structured them in a way that allows for the optimisation of service level and operational costs to the final customer.

Keywords: omnichannel; 4PL; digital logistics; ship-from-store; SFS; last mile.

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1 Introduction

Pioneering omnichannel retailers leverage digital technologies to reinvent their operations and increase sales (Aktas et al., 2020). Omnichannel means the integration of sales channels – whether offline or online – of a company to improve the purchasing experience of consumers (Cai and Lo, 2020; Du et al., 2019; Gupta et al., 2019; Jin et al., 2020; Pereira et al., 2020; Yang and Zhang, 2020a). Therefore, omnichannel operations embrace the interaction and synchronisation of retailing customer service channels (Schubert et al., 2020).

Until recently the retail stores were the endpoint of the transportation networks that left the distribution centres. Nowadays, given the new commercial relations, these stores can be the starting point for delivering the product to the customer, or even for goods internal redistribution (Li, 2020; Souza et al., 2022). To better accommodate these new relationships, in which the e-commerce coexists with traditional physical stores, a ship-from-store (SFS) process emerges (He et al., 2021a). With the application of SFS, companies manage the process of sending orders online using stock from a local offline store instead of a distribution centre (Yang and Zhang, 2020b). This allows consumers to place orders online and to pick them up at selected stores or to receive them as a shipment from a store (Lim et al., 2018; Hübner et al., 2016).

Gao and Su (2017) justify that customer want the products to be available anywhere, anytime, and at an affordable price. These consumers evaluate the possible pros and cons of each alternative offered. When making the purchase decision, they strategically choose a channel that optimises their rewards. Thus, the introduction of SFS decreases delivery time and makes the digital channel more attractive to the customer as well as more cost-effective for the company (Acimovic et al., 2018). Therefore, reallocating the stock located in a specific point, distributing it to other stores, will increase companies' sales potential. It also enables faster and more efficient delivery to the customer (Bayram and Cesaret, 2020a). This practice seeks for operational simplicity, where most retailers usually fulfill orders sold via e-commerce from a maximum of two stores closer to the regions of high customer flow (Wei et al., 2020).

Another critical decision is to choose the best transport option to deliver the products to the end customer. For the retailer, managing its own transportation network with contracted drivers can be a competitive advantage. At the same time, outsourcing is a second alternative, also viable but less competitive (Yang and Zhang, 2020b). Another approach is to use fourth-party logistics (4PL) operators to manage the delivery process. 4PL provides innovative solutions for the distribution and supply chain through a combination of technology, resources, and optimisation, addressing the context of digital logistics and using their knowledge (Lu et al., 2020). Oppong (2016) presents that modern supply chains are moving towards 4PL services, which can strategically make companies' distribution services more competitive. Thus, the 4PL option is suited to the omnichannel environment with SFS.

This article aims to propose a SFS omnichannel operation model which is orchestrated by a 4PL platform, integrating retailing processes with transportation third-parties. To achieve this goal, we review the literature on digital logistics, last mile, omnichannel, 4PL and SFS, to define concepts and characteristics that can be helpful in the construction of the conceptual model. This research contributes to integrating three major topics in the retail context: omnichannel, physical distribution, and digital logistics. More specifically, it helps to understand the role and contributions of a 4PL in the SFS and last mile applications. Through a good orchestration of their processes, a retailer can achieve, besides the increase in the level of service offered to the customer, a significant reduction in logistics costs (Gencer and Akkucuk, 2020; Gruchmann et al., 2020; Levina and Razumova, 2019; Lu et al., 2020; Vivaldini and Pires, 2013).

The remaining sections of this article are structured as follows. In Section 2, the methodology used in this article is described. In Section 3, the results of the qualitative and quantitative analysis are presented, followed by the conceptual model in Section 4. Finally, in Section 5, the conclusions and directions of future research are presented.

2 Research methodology

The conceptual model proposed is based on a systematic literature review contemplating omnichannel, SFS, last mile, 4PL, and digital platforms. Thus, as a methodology for this article, the preferred reporting items for systematic review and meta-analysis (PRISMA), described by Moher et al. (2010) was used. The steps applied by Uhlmann and Frazzon (2018) were replicated in this research. After that, we designed the conceptual model based on the definitions presented in the literature review.

2.1 Papers identification

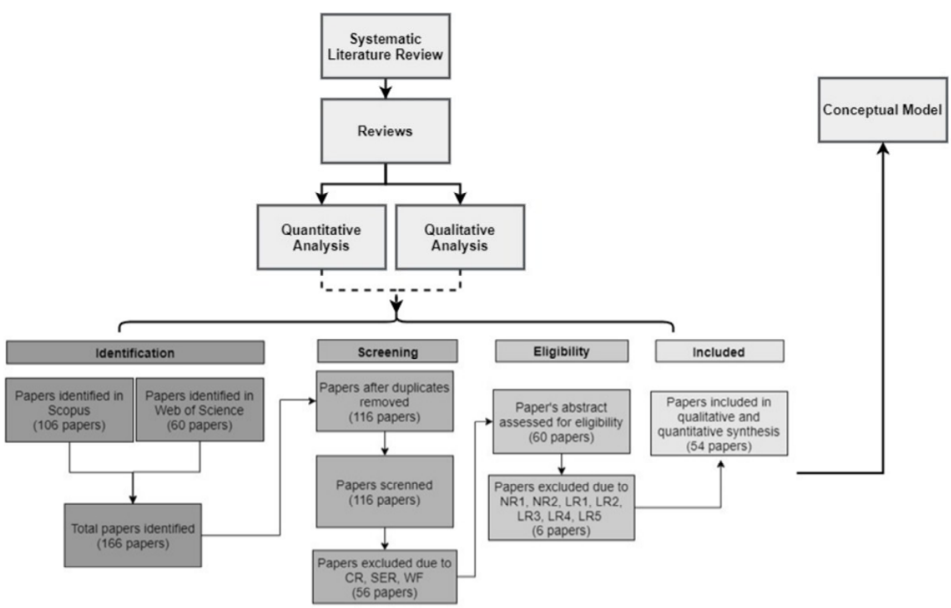
For the first step of identifying the articles, two research bases were chosen: Scopus (http://www.scopus.com) and Web of Science (http://www.webofknowledge.com), where we used the following sets of words for research: (('digital logistic') OR ('digital logistics') OR ('SFS') OR ('ship from store') OR ((omnichannel) AND ('last mile')) OR ((('fourth party logistic*') OR ('fourth-party logistic*')) AND (logistic*))). For the inclusion and exclusion process of articles, specific criteria were used that are directly involved with the problem of this article and that followed the proposal of Liao et al. (2017). These criteria can be verified in Table 1.

After the survey of the articles and structuring of the inclusion and exclusion criteria, the duplicates were removed using the R Studio software, which was also used to perform the bibliometric analysis with the Bibliometrix package, developed by Aria and Cuccurullo (2017). Thus, the CR, SER and WF selection steps were carried out by reading titles, abstracts, and keywords. The remaining articles in the review were read and the criteria NR1, NR2, LR1, LR2, LR3, LR4, and LR5 were applied. Figure 1 demonstrates the step-by-step application of this methodology.

Table 1 Exclusion and inclusion criteria

	Criteria	*Criteria explanation*	
Inclusion	Closely related (CR)	The article is explicitly dedicated to omnichannel, ship-from-store, digital logistics, last mile and 4PL; Time period: before February 01, 2021. Article as type of document Article and in English	
Exclusion	Search engine reason (SER)	An article has only the title, abstract and keywords in English, but not the full text in English	
	Without full-text (WF)	A paper without the full text to be evaluated	
	Non-related (NR)	NR1	An article is not an academic article
		NR2	A paper is not aligned with, omnichannel, ship-from-store, digital logistics, last mile and 4PL, the title indicates another subject
	Loosely related (LR)	An article does not focus on discussing omnichannel, ship-from-store, digital logistics, last mile and 4PL. In which	
		LR1	This is used only as an example in fact
		LR2	It is used only as part of its future research direction
		LR3	It is used only as a quoted expression
		LR4	It is used only in keywords or references
		LR5	Research that does not address the context

Figure 1 PRISMA steps demonstrating the phases of this review



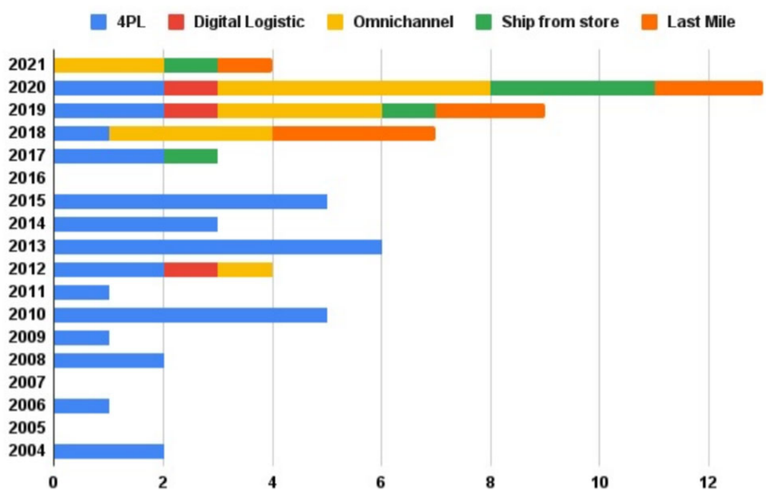
3 Results

The quantitative analysis seeks to identify patterns to understand how the number of publications evolved and which research area has gained more attention. The qualitative analysis focuses on deeply analysing the content of the identified papers to extract concepts that allow the design for the conceptual model.

3.1 Quantitative analysis

Figure 2 shows the annual progress of research on the topics addressed, based on the 54 articles included. These surveys began in 2004, and after 2017 there is a sharp increase in publications. The year 2020 is the year with the largest number of publications in this area. The trend line highlights the increase in these subjects' research in the last decade, confirming their relevance.

Figure 2 Annual evolution of publications by subject (see online version for colours)



Nonetheless, analysing these papers by subject will provide a clearer understanding of this evolution. Figure 2 shows the number of papers by subject in each year. As can be seen in Table 2, some of them deal with more than one subject related to this research (counted more than once in Figure 2). It is clear that 4PL was initially studied in literature, ensuring a more mature subject in research today. But the main point in Figure 2 and Table 2 is that the subjects addressed in this paper begin to be treated simultaneously as of 2018 (with one exception in 2012). It evidences the importance of better understanding the relations between those topics and suggests a path to be followed.

3.2 Qualitative analysis

This section presents the analysis of content of the selected articles. It provides the concepts that allow the development of the conceptual model described in the next session.

Table 2 Articles by research subject

Digital logistic	Dai and Wu (2012)
Omnichannel	Rai et al. (2019, 2018)
4PL	Bhatti et al. (2010), Bo et al. (2010), Büyüközkan et al. (2009), Cezanne and Saglietto (2015), Chen and Su (2010), Cheng Hong et al. (2008), Cui et al. (2013), Hingley et al. (2011), Huang et al. (2013, 2019, 2015), Leong and Cheong (2012), Li et al. (2015, 2014), Liu et al. (2014), Lu et al. (2020), Mukhopadhyay and Setaputra (2006), Neaga et al. (2015), Pan et al. (2010), Papadopoulou et al. (2013), Pavlić Skender et al. (2017), Prashar (2020), Qian et al. (2018), Tao et al. (2017), Visser and Lambooy (2004), Vivaldini and Pires (2013), Wei-Qiong (2014), Win (2008), Xu (2013), Yao (2010, 2013), Ye and Wu (2015) and Zhang et al. (2005)
Last mile	Aktas et al. (2020), Castillo et al. (2018) and Mikl et al. (2020)
Ship-from-store	Cordón et al. (2017)
Ship-from-store and omnichannel	Bayram and Cesaret (2020), He et al. (2021), Li (2020) and Yang and Zhang (2020)
Last mile and omnichannel	Arslan et al. (2020), Buldeo Rai et al. (2021, 2019b, 2019a), Faugère and Montreuil (2020), Lim and Srai (2018), Lim and Winkenbach (2019) and Weber and Badenhorst-Weiss (2018)
Digital logistic and 4PL	Levina and Razumova (2019)
Omnichannel and 4PL	Hosie et al. (2012)

3.2.1 Omnichannel

The changes occurring from the internet and other related technologies have allowed products and services to be bought and sold anywhere in the world, no matter how large or small the company is. The internet allows organisations to expand their service offerings, improving their business-to-business operations and their B2C services (Weber and Badenhorst-Weiss 2018). It enables companies, both small and large, to expand their global presence at a lower cost than ever before. Product and service information are available in real-time and quality comparisons can be made quickly (Bayram and Cesaret, 2020; Buldeo Rai et al., 2019; Faugère and Montreuil, 2020; Pereira et al., 2018; Mazzuco et al., 2018). Omnichannel can be defined as the synergistic integration of customer touchpoints and communication opportunities to create an experience regardless of channel, platform, or stage in the sales process (Cummins et al., 2016; Pereira and Frazzon, 2021). Omnichannel retail emerged from multi-channel retailing, which implied a distance between the traditional brick and mortar store and the online store (Hosie et al., 2012; Lim and Srai, 2018; Li, 2020).

Omnichannel retailing is no longer something to be considered, but instead has become a must-have for any industry to survive and prosper. Consequently, a fully integrated omnichannel has large amounts of data collected and analysed to create customer insights to correctly personalise consumer experiences (Bayram and Cesaret, 2020; Rai et al., 2019; Faugère and Montreuil, 2020; He et al., 2021; Hosie et al., 2012; Li, 2020; Lim and Srai, 2018; Buldeo Rai et al., 2019; Weber and Badenhorst-Weiss, 2018; Yang and Zhang, 2020b). Thus, we assume that for a retailer to achieve success, we need to have an omnichannel operation included in our model. As well as a digital platform that allows and concentrates this range of data received from these omnichannel processes, which here in our paper, we call the logistics orchestrator.

Rai et al. (2018) sought to evaluate how the servers of logistic operations are adapting to the behaviour of the omnichannel retail, as well as the customers' perception of this level of service. Thus, it was obtained as a result that 38% of the consumers would never shop with an online retailer again after a negative shopping experience; 45% of the consumers abandon their shopping cart online due to unsatisfactory delivery options, and 87% of the consumers will likely buy again with an online retailer after a positive delivery experience (Rai et al., 2018). The need to bring the best customer experience is present. Therefore, we need to develop a model that allows us to bring the best delivery cost options and with quality. We address these situations in our model by being connected to different logistics operators that compete with each other for the lowest transportation cost as well as quality evaluation criteria in previous deliveries. This large number of integrated logistics operators favours these two points pointed out in Rai et al. (2018).

The need for a better level of customer service affects retailers. There is a need to improve the channel of information to the customer for real-time monitoring and other delivery methods with lower cost and time. Logistics outsourcing by a 4PL can be seen as a trend for retailers, in which it becomes a competitive advantage against the competition. Also, there is a visible movement of startups that arise to solve this gap, where they deploy the best experiences of last mile with innovative solutions, concern with the environment, and high value (Çağlar Kalkan and Aydın, 2020; Lim and Srai, 2018; Rai et al., 2018; Weber and Badenhorst-Weiss, 2018; Pereira and Frazzon, 2019; Souza et al., 2020). The research of Rai et al. (2019) signals that organising an omnichannel retail model is challenging from a logistic point of view due to the great complexity of integration required. This logistical complexity pointed out by the authors, as well as the tendency to use services from a 4PL is understood as the basis for the model presented in this paper. We use the denomination 'logistics orchestrator'.

From an internal perspective, retailers cannot usually design and provide complex integration infrastructure. Since the key design variable in omnichannel retail is the integration between online and offline, a supply chain redesign is necessary. It requires a comprehensive fusion of front-end and back-end systems and developing new logistics concepts, e.g., home delivery, in-store collection, and product handling. Particularly challenging is the last link in the supply chain that directly connects the many 'product to consumer' paths that are possible in omnichannel retail. This last mile concept of omnichannel retailing is important, but challenging, because of its impact on consumer satisfaction, its high costs and environmental implications (Rai et al., 2021; He et al., 2021).

Rai et al. (2019) point out in their study the need for measuring the environmental impact from the retailers' logistics. In the study with a retailer located in Belgium, the concern to provide sales channels that reduce pollution becomes an attraction to the customer. Also, the paper presents that 38% of consumers in the USA make purchases through an omnichannel. In Belgium are 64%, where both are in development and exponentially increase. The authors also present six profiles of customer behaviour in buying omnichannel: two types of buyers from a single channel ('the online buyer' and 'the traditional buyer'), two types of omnichannel buyers who buy in the store ('the research buyer' – they gather information in stores to decide to buy physically and 'buyers' – go to the store to buy) and two types of omnichannel buyers who buy online (‘the showroomer’ – check the product physically but decide to buy online and ‘the buyer who clicks and collects’). However, single-channel shoppers still represent the majority of consumers (Rai et al., 2019).

Still, in the context of omnichannel, choosing the best stock decentralisation strategy is a key factor for the operation to succeed. It affects the SFS availability, as well as how these products will be delivered to end customers (Arslan et al., 2020; Bayram and Cesaret, 2020; Rai et al., 2021; He et al., 2021; Weber and Badenhorst-Weiss, 2018). It is by filling this gap that the conceptual model discussed in this paper also seeks to orchestrate the best selection of the shipping point for the material to the consumer.

Weber and Badenhorst-Weiss (2018) present a practical experience of a company that failed to develop online channels. Austin Reed, 116 years old, declared bankruptcy in 2016 for not aligning its online operations with offline. This mistake led to its operational cost increase. The authors mention that choosing great logistics operators to deliver the best experience to the customer in the final delivery is essential while integrating online and offline channels.

The present literature on omnichannel is in significant development due to globalisation and new trends presented by the authors. As explained, the main gap is how to deliver products through different sales channels with the lowest cost and highest quality, so that the customer can make a purchase quickly and safely. The growing studies bring knowledge to retailers, who are the most affected by this new challenge. Also, to achieve a level of service that matches the customer’s wishes is necessary to encompass or integrate other concepts researched in this paper. The following sections present these concepts

3.2.2 Ship-from-store

Until some years ago, retail stores were used only as the end of transport networks, receiving goods from distribution centres. Now, retail stores also need to send goods to a customer’s home or another store, this process is called SFS that is one of the omnichannel implementations (Arslan et al., 2020; Bayram and Cesaret 2020; Cordón et al., 2017; Li 2020; He et al., 2021; Weber and Badenhorst-Weiss, 2018; Yang and Zhang, 2020b).

Among several omnichannel initiatives, store shipping is ranked with the highest priority (18%), and about one in three omnichannel retailers adopted SFS in 2016. Retailers can benefit from store delivery in several ways. First, orders can be shipped faster and generally cheaper than shipping from the distribution centre, as local stores must be closer to customers than the distribution centre. Second, it can positively impact gross margins by preventing stores from reducing the price of a product, since store inventory can be used to fulfil online orders at full price. However, evolution requires greater integration of processes and platforms that fully meet this demand (Bayram and Cesaret, 2020). The SFS process was then considered in our model because it is fully connected with the omnichannel policy that we also address in this model. Aiming to achieve the shortest possible delivery time to the customer, placing the products closer to them, and consequently reducing transportation costs, this operational change has significantly reduced customer wait times and shipping costs – it is one of Best Buy’s secrets to tackling the rapid rise in online shopping. As this practice matures, retailers can gather inventory from nearby stores, especially for highly populated regions (Li, 2020).

For example, Zara, a fashion giant, converts its physical points of sale around the world to fulfil orders. In addition, GAP, another apparel giant, uses SFS to link offline store inventory to online business. The introduction of SFS can shorten online order delivery time, thus increasing the attractiveness of the digital channel. However, companies need to be prepared for this increase and the impact on the physical channel. Cross-selling physical in-store and online at the same time further increases the competitive advantage of companies who adopt SFS. SFS accelerates online order delivery and increases retailer brand awareness, thus enabling the company to broaden its customer base (Yang and Zhang, 2020a). This attractiveness to the digital channel compiled with the best customer experience is understood in our proposed model.

Today, consumers are more sensitive to time, and many expect their orders to be delivered quickly. These time-sensitive consumers pay more attention to product delivery time than to product price. To meet the needs of time-sensitive consumers, retail platforms have offered express logistics services that allow consumers to place orders in the morning and receive products in the afternoon of the same day (He et al., 2021; Faugère and Montreuil, 2020). Based on this customer sensitivity, we propose a model that is connected to a vast amount of logistics operators that can offer various delivery possibilities at different times and costs.

Amazon also offers different service options; consumers can receive their products more quickly by paying extra shipping fees or by signing up for the platform. However, most online retailers can establish only a few warehouses in a country to fulfil all online orders, leading to longer delivery times for consumers. With advanced technologies such as big data and artificial intelligence, companies can control the production, circulation, and sale of commodities in real-time. Companies can deeply integrate online services, offline experiences, and modern logistics through operational innovation to improve the consumer's shopping experience. For example, Xiaomi, an online smartphone supplier first known in China, used to sell products only through online stores, but the company began opening physical stores in 2017. After this opening, Xiaomi's shipments increased 70% over the previous quarter due to a shorter lead time. Meilele, a pioneering Chinese furniture retailer on the internet, also opened physical stores across the country. Both implemented SFS methods to improve the level of customer service. A Chinese snack retailer with both online and offline channels answered a 'double eleven' order in just 11 minutes, using inventory from its nearest store. A fashion retailer, Zara, managed to get delivery on the same day and even within two hours, adopting the store send option (He et al., 2021).

One gap in a bad SFS strategy is the distribution of stock to stores, which needs to be carried out in a highly strategic manner (Arslan et al., 2020; Bayram and Cesaret, 2020; Cordón et al., 2017; He et al., 2021; Li, 2020). The 4PL presented as the logistical orchestrator in the model proposed in this article, also aims to be integrating in real-time with the stocks present in each store. Thus avoiding order allocation failures where there is no stock available, compromising the customer experience. Another problem is related to the so-called multi-item order. Usually, an order may consist of more than one item. When at least one of the items cannot be shipped from the closest location, the retailer has to check if it is possible to fulfil all the items from another location, or it will have to split the shipment. Therefore, as additional decisions take place, the management complexity increases. To orchestrate the split shipments, the retailer will have to decide how to split the order and which locations will fulfil each of the resulting split orders

(Bayram and Cesaret, 2020). This step, when orders that apply a non-existent stock in a store, is also understood in our model.

Based on the authors and this review, we can reflect and interpret different views and benefits of the SFS process applied in a retail context. This policy indicates a stock management in each store with the use of technological control resources in order to manage this chain. Thus, providing a reduction in cost and delivery time to the customer, because the product is located closer to him. The set of technology, inventory management, delivery time and cost, provides an increase in the level of customer service, in which, according to the authors, they tend to feel more satisfied.

3.2.3 Last mile

Weber and Badenhorst-Weiss (2018) define last mile logistics as: the last stretch of a business-to-consumer (B2C) order delivery service. In times of retail digitalisation, consumers are increasingly buying online (omnichannel) and, with this, raising the last mile presence. Also, it is the most expensive part of the supply chain, representing between 50% and 75% of all costs, which varies according to the company's strategy (Rai et al., 2019; Lim and Winkenbach, 2019; Lim and Srai, 2018; Masudin et al., 2021; Nayak et al., 2021; Ulhoa et al., 2021; Yadav et al., 2021).

The distance between the logistics facilities and the end customer enhances inefficiencies (it can increase between 5 to 23 times the cost of a product of a purchase made physically in the store). The inadequate routing also affects the cost, but the concept of SFS using digital platforms can achieve better performance regarding this issue. Since the end customer will not bear the cost, retailers need to reinvent themselves to cushion this inefficiency by better utilising their strategic stock in each store to approach the customer (Rai et al., 2019). Thus, the model proposed in this paper seeks to fill this gap through a logistics orchestrator on a digital platform.

After a survey with companies, the paper of Rai et al. (2019) points out that the rates of failure in the last mile can range from 2% to 30% of orders. Local numbers from different countries are: the UK varies from 13% to 14%, Holland has an average of 25%, and Belgium has an average failure rate of 14%. Besides these failure rates, around 30% to 50% of the vehicles leave for the delivery route without its capacity 100% taken in an urban context. It shows the importance of better routing strategies. These strategies in our model are effectively consolidated with real-time communication with the customer to reduce failure rates.

Companies are seeking a better alternative via digital platforms to provide the customer with a greater experience with their purchase. Thus, integrating digital experiences ends up adding value, where companies seek to integrate innovative transport technologies into existing distribution systems. Examples that can reduce this last mile transportation cost is the sharing of rides, facilitated by Uber and Lyft, which distribute costs and benefits connecting independent cars to companies through an application (Weber and Badenhorst-Weiss, 2018). Companies like Amazon and UPS have been investing heavily in using these alternatives to achieve same-day deliveries, called 'crowdsourced logistics', since these independent drivers have the flexibility and greater agility to make the delivery. A trend is to incorporate them into a contracted transport network of these own companies (Castillo et al., 2018). This trend pointed out in the literature is addressed in the proposed model by using the autonomous vehicle network itself to perform the last mile step. These drivers can then connect to the retailer to make their deliveries, as well as to other companies.

The use of vehicle sharing integrated with an own fleet network can reduce the retailer distribution cost by up to 44% (Aktas et al., 2020). Also, according to the authors, some more indicators achieved in this study in the UK were identified, among them: 22% reduction in distance of the route with vehicle sharing and 63% of annual routes are reduced.

The concept of crowdsourced is growing in the last mile context, as it belongs to the scenario of shared economy, where the assets are optimised through digital platforms. Thus, the people who provide the service are individuals, amateurs or not, who have the willingness to carry out the delivery service in the last mile. One can also call it a 'Uber for last mile'. This way, there is always an exchange, i.e., a win-win relationship (Aktas et al., 2020; Rai et al., 2018, 2019; Castillo et al., 2018; Faugère and Montreuil, 2020; Lim and Winkenbach, 2019; Weber and Badenhorst-Weiss, 2018; Frazzon et al., 2019).

In addition, this alternative is efficient in the Netherlands, Spain, the UK, and the USA, since 61% of consumers who have used a crowdsourced service bought again at the same location. In this survey, 76% of consumers prioritise reliability and speed of delivery, 67% prioritise buying where they have better delivery options, 58% buy a product online every three months, 21.5% buy a product online every month, 5.4% buy a product online every week, 67.7% receive their products purchased online at home, 11.5% decide to pick up their products at the distribution sites, 5.9% decide to receive orders at their place of work, 21% are interested in receiving orders from non-professional drivers, 88.6% are interested in receiving a notification when the order goes out for delivery, 79.4% are interested in receiving notification when the order is within an hour of arrival (Rai et al., 2021).

Rai et al. (2021) sought to identify which types of consumers are interested in a crowdsourced process in the last mile and the best level of service for them. This survey was conducted in Belgium and applied to 1,000 consumers. As a result, of this survey, it was understood that the delivery of the last mile performed with the use of drones, electric vehicles and auto collection in cabinets or lockers are the main delivery alternatives evident for this group surveyed. It is through the results presented by Rai et al. (2018) that we bring into the conceptual model the management through orchestrated retailing of a network of self-employed drivers.

The need to improve the customer experience in last mile processes becomes increasingly important as pointed out in the literature. To add value at this stage, transparency with the customer, as well as his integration with the retailer becomes essential through technological resources that aim to notify feedbacks to the customer in real-time, as even in the speed of delivery. To be successful, the last mile process needs to be connected and integrated with all the other steps of the retail process, such as stock availability. This integration to bring the best experience to the customer, is clearly a challenge present today, along with the choice of the best method of transportation.

3.2.4 PL and digital logistics

The 4PL is a supply chain integrator that brings together the resources, capabilities, and technology of its own and other organisations to design, build and execute comprehensive supply chain solutions (Cui et al., 2013; Huang et al., 2013; Xu, 2013; Yao, 2013; Huang et al., 2015, 2019; Ye and Wu, 2015; Li et al., 2015; Pavlić Skender et al., 2017; Tao et al., 2017; Weber and Badenhorst-Weiss, 2018; Qian et al., 2018; Levina and Razumova, 2019; Prashar, 2020).

Digitisation and new technologies have a significant influence on outsourced logistics business models. Therefore, new digital providers can affect the entire value chain. However, there is a lack of understanding about the influence of digital business models in logistics (Lim and Srai, 2018; Buldeo Rai et al., 2019; Levina and Razumova, 2019; Lim and Winkenbach, 2019; Mikl et al., 2020). A 4PL, uses the concept of digital logistics making use of technological resources for its process and are currently the most prepared to fill this difficulty in understanding these new logistical solutions (Lim et al., 2018; Buldeo Rai et al., 2019; Levina and Razumova, 2019; Lim and Winkenbach, 2019; Mikl et al., 2020). Due to this concept, the model developed in this research is based on this actor, that makes use of technological resources to integrate the various actors in the chain.

There is a trend shown in Dai and Wu (2012) about platform solutions, motivated the model developed in this study to also orchestrate a platform omnichannel process. It is worth noting that these online digital logistics platforms have no assets. They calculate routes and offer the best prices quoted instantly based on algorithms. Everything is done online until hiring, using databases and artificial intelligence. In other words, they have no transport capacity since they can connect with logistics operators. Although these actors are still maturing, there are already positive results that need to be better studied (Mikl et al., 2020).

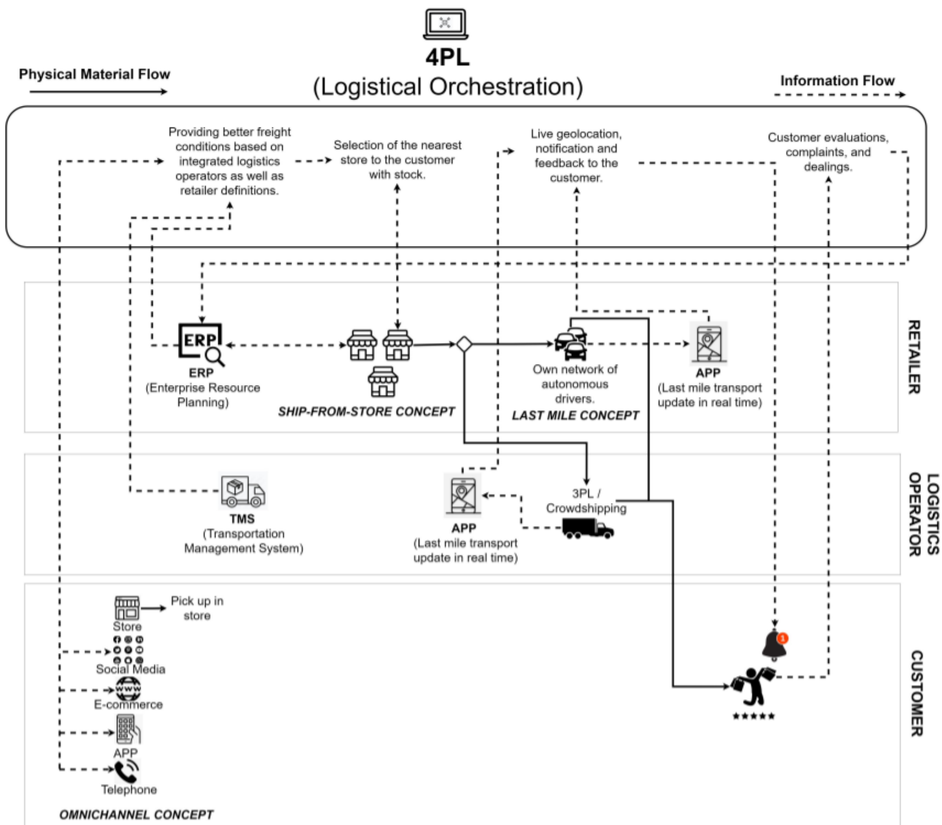
In the study of Gruchmann et al. (2020), 4PL acts as a supply chain integrator. It generates a supply chain solution and manages all the logistics activities necessary for a company, including 3PL, from the daily management to the operational level. Hence, the company can focus on strategic level management (Çağlar Kalkan and Aydın, 2020). It is based on this evidence that we design in this article a logistical orchestrator called (4PL), which has the necessary competence, as the literature says, to orchestrate a logistical process from beginning to end (Huang et al., 2019; Vivaldini, 2019; Gencer and Akkucuk, 2020). By identifying the need throughout the literature for an omnichannel process orchestration, the literature related to 4PL presents it as a solution to the process. Which strongly justifies our model. According to Lu et al. (2020), the joining of several 3PLs within a logistic orchestrator can achieve a truly measurable cost reduction when integrated with the focus on freight cost reduction to the end customer. This cost reduction encourages us to think of a model that allows this vast integration of logistics operators.

These platform solutions are also present in other studies where it is observed the gain in percentage in the ratio of losses and damages that were reduced with the cooperation of an integrated 4PL with several 3PL, that is, it is a scientifically proven potential to be applied in companies that are evolving towards digital logistics, since the 4PL controls and optimises the entire logistics process as a goal in achieving high operational efficiency (Li et al., 2014; Liu et al., 2014; Wei-Qiong, 2014; Cezanne and Saglietto, 2015; Neaga et al., 2015; Pavlić Skender et al., 2017; Tao et al., 2017; Weber and Badenhorst-Weiss, 2018; Huang et al., 2019; Prashar, 2020).

4 Conceptual model

As shown in the previous section, integrating SFS concept can improve omnichannel operations' performance. Furthermore, it can be orchestrated using a 4PL, aiming to improve customer service level and to reduce costs by integrating digital logistics tools and using contracted or outsourced carriers. Therefore, a conceptual model Figure 3 based on the literature review and on empirical evidence from a practical application is hereby proposed.

Figure 3 Conceptual model (see online version for colours)



Initially, the model considers an omnichannel retailer with different channels to offer products to the customers. However, we explore online purchases as the main channel. When entering the retailer's digital channel, the client chooses the product he wants to acquire, puts it on the cart, and simulates the delivery time and freight value. At this moment, an interaction with 4PL is needed to get the delivery information. From one side, the 4PL platform will integrate with the retailer sales system. On the other, it will integrate with the transportation management system (TMS) of each 3PL on its database. Thereby, the 4PL is able to search through its 3PL partners to find the one that best meets the order. Once the delivery time and freight value are retrieved, the retailer can add security margins or apply discounts before displaying those values online. These logistic rules are dynamic and can be updated at any time according to the retailer's strategy.

The customer who chooses to purchase the product has his payment processed by the retailer's digital channel. After that, this order is processed within the retailer's enterprise resource planning (ERP) and integrated with 4PL. This order continues integrating via electronic data exchange with the carrier that at that time, taking into account the freight rules, was acquired by the customer. After this integration with the logistics operator, the same receives information and a collection request, in which it proceeds with the collection. This logistic operator can be a fleet of contracted drivers dedicated to the last mile, that is, in metropolitan regions where there is a strong sales potential in a small radius of the store, or it can be via 3PL that serves long distances.

The store that will deliver the product will be the one that is closer to the client. This definition occur just after the order is issued and before invoicing. Then, when the carrier receives the collection information, the SFS process has already been previously defined. This decentralised stock visualisation and store shipping is integrated with 4PL and, based on the indicators provided, it can be also used to support a strategic stock decentralisation. After the product leaves the store, the information is available in the 4PL platform so that the needed information exchange and management can be performed. This platform allows for the management of issues with the 4PL through a unifie channel, avoiding dealing with multiple carriers in parallel. In other words, it is possible to manage all orders from start to finish in a single platform. The customer is also integrated in this platform, receiving real-time information on geolocation, as well as change of order status in transportation. Again, here 4PL can allow the retailer to choose how he wants to communicate with the customer, what notices he wants to demonstrate, how he wants to evaluate the delivery, how he will receive feedback from the customer, all this through the 4PL logistics orchestration platform.

The customer, during the whole process, can get in touch to request adjustments. In this way the retailer and 4PL can act preventively, before shipment or even during the transport process with the carriers, so that customer's requests are considered in real-time. Thus, for transportation management, the platform allows for the collection analysis, calculation of expected delivery time, the access to the service indexes of each carrier as well as their qualification. Furthermore, the anticipated diagnosis of potential problems with the delivery are essential for the transparency with the client.

At the time of delivery, the client is allowed to evaluate the order. This information is made available in the platform for evaluating the performance of the retailer. To carry out all this, the 4PL is present in all stages, integrating systems and besides orchestrating the operation technologically. The orchestration platform performs the exchange and storage of real-time data, so that everything is fed correctly, providing the best level of service to the final customer and minimising the cost of the retailer, adding the concept of end-to-end visibility.

5 Conclusions, limitations and directions for future research

Omnichannel retailing operations need to be structured to ensure retailers competitiveness and survival. SFS and last mile approaches can impact positively on customer service level and operational costs, while increasing management challenges. Therefore, retailers are impelled to adopt 4PL services which bring in expertise and technology, such as orchestrating platforms. In this context, this article reviewed current literature and proposed a SFS omnichannel operations model, orchestrated by a 4PL digital platform, integrating retailing processes with transportation third parties.

The use of 4PL for logistics processes is increasingly relevant. This becomes even more evident in omnichannel retailing, which comprises SFS, digital logistics and last mile approaches. The proposed conceptual model aims at the added-value orchestration of processes from the first contact with the customer to the post-sale. Furthermore, operational activities using this model are integrated and optimised, where the retailer is concerned with strategic decisions, while the 4PL manages operations and handles the data exchanged in real time with third parties and the end customer.

Finally, some limitations and future research perspectives. First, adding the management of financial flows in the proposed model would represent an interesting research avenue. Second, the practical application of the proposed model in a real omnichannel retailer scenario would substantiate the potential gains already identified hereby. Exploration of the potential practical gains needs to be simulated in future research. Locating other practical experiences that are not incorporated in scientific journal publications can also be a way to develop this model. Since there may already exist some similar solutions being practiced outside the literature researched. This search for solutions that come close to this model, but are not scientifically registered, shows a practical implication. In future studies also after evaluation in real cases, it is interesting to direct to which type of retailer this model is best applied, since practical experience can direct this. This issue ends up being a practical implication and limitation of this research, since we have a generic model of a retailer's operation.

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