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Challenges at the marketing–operations interface in omni-channel retail environments☆

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ABSTRACT

To compete in today's omni-channel business context, it is essential for firms to co-ordinate their activities across channels and across different stages of the customer journey and the product flow. This requires firms to adopt an integrative approach, addressing each omni-channel design decision from a dual demand-side (marketing) and supply-side (operations) perspective. However, both in practice and in academic research, such an integrative approach is still in an immature stage. In this article, a framework is developed with the following key decision areas: (i) assortment & inventory, (ii) distribution & delivery and (iii) returns. These affect both the customer journey and the product flow. As a consequence of the resulting interdependencies between the firm's functions, addressing the issues that arise in the three decision areas requires an integrated marketing and operations perspective. For each of the areas, the key decisions that affect or involve both the customer journey and product flow are identified first. Next, for each decision, the marketing and operational goals and the tensions that arise when these goals are not perfectly aligned are described. The opportunities for relieving these tensions are also discussed and possible directions for future research aimed at addressing these tensions and opportunities are presented.

1. Introduction

A customer's journey passes through several stages, starting with the recognition of a need and ending with a post-journey evaluation. In today's omni-channel environment, this journey is increasingly characterised by consumers switching between channels (e.g., store, retailer website, price comparison app) both across and within stages. It is even common for customers to simultaneously use different channels (e.g., checking online prices inside a physical store). This changing nature of the customer journey has become a central theme in marketing research (Verhoef, Kannan, & Inman, 2015). At the same time, a growing number of researchers in operations management are focusing on examining the product flow throughout the entire supply chain to the final customer (Marchet, Melacini, Perotti, Rasini, & Tappia, 2018). The omni-channel environment has become an important driver for changing procurement and inventory policies and of innovation in distribution and returns management. This has resulted in greater integration among the various product flow stages to provide a highly valued, cost-efficient, and flexible service.

In recent years, an omni-channel context has become the dominant situation in most markets. Omni-channel retailing has been defined as a business model in which different channels are fully integrated to provide a seamless experience throughout a customer's journey (Brynjolfsson, Hu, & Rahman, 2013; Verhoef et al., 2015). Optimising performance in one channel is often suboptimal because customers prefer to choose their own mix of channels, want to switch between channels and expect consistent, seamless and reliable service throughout their journey (Sousa, Amorim, Pinto, & Magalhães, 2016). Moreover, in their searching and ordering decisions, customers integrate the full range of product, ordering, delivery services and, if

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applicable, return policies. Thus, to provide a fully integrated experience, practitioners and researchers acknowledge that co-ordination across channels, and across different customer journey and product flow stages, is essential.

Being successful in today's omni-channel markets requires an integrative marketing–operations perspective to addressing the key decisions that give rise to the interdependencies between customer journey and product flow (Rooderkerk & Kök, 2019; Saghiri, Wilding, Mena, & Bourlakis, 2017). Despite this, researchers have typically investigated aspects of integrated product flow management, channel and customer journey management solely from the perspective of their own knowledge domain (Nguyen, de Leeuw, & Dullaert, 2018).

To address this gap, this paper discusses the marketing–operations interdependencies throughout different stages of both the customer journey and the product flow from the perspective of omni-channel management. Specifically, it focuses on three key decision areas for which these interdependencies are paramount: (i) assortment & inventory, (ii) distribution & delivery and (iii) returns. Although both goods and services may be purchased and delivered in an omni-channel environment, the research focuses on goods because they pose the most challenging integrative issues across channels and process stages.

This study makes the following contributions. First, it addresses the tensions and challenges that arise in the key decision areas that link a firm's marketing (focus on customer journey) and operations (focus on product flow) functions. Second, it highlights the opportunities in terms of new technologies, control practices, data analytics and new business models to reduce these tensions. Doing so will lead to a better alignment of the firm's marketing and operations functions, which should enable the seamless omni-channel journeys that customers increasingly expect, in a cost-efficient manner. The final contribution is to identify research gaps and, consequently, opportunities for future research with respect to an integrative marketing–operations perspective to omni-channel management.

The outline of the paper is as follows. First, Section 2 presents the flow model which links the omni-channel customer journey (customer flow through the decision process) to the product flow (flow of products to and from the consumer). The links are identified as a firm's key decisions, divided across three areas (assortment & inventory, distribution & delivery, and returns) that affect both customer behaviour during the journey (*demand*) as well as the product flow within the firm (*supply*). Given the interdependencies between customer journey and product flow, this article provides an integrative marketing–operations perspective for each decision area in Sections 3–5 respectively. More specifically, for each area, the main decisions to be made are first identified. Next, for each decision, the goals of the firm's marketing and operations functions are defined. The resulting tensions are discussed to the extent that these goals are not perfectly aligned. Then, for each decision, opportunities to relieve these tensions and better align the distinct goals are discussed. Each section ends by identifying a series of research gaps and an agenda for future research. The findings of this research are briefly summarised in Section 6.

2. Flow model

To structure this paper's discussion on the interdependencies between customer journey (*demand*) and product flow (*supply*) in an omni-channel environment, it presents a flow model consisting of three panels (Fig. 1). The central panel (b) highlights the key decision areas in omni-channel retailing which relate to both the omni-channel customer journey (customer flow), depicted in panel (a), and product flow in panel (c). While a firm's marketing function typically focuses on facilitating seamless customer journeys that result in steady revenue streams, the operations function is typically tasked with ensuring a cost-efficient product flow. Consequently, the key decisions in panel (b) affect, and are affected by, the marketing and operations functions. Since the goals of these two functions are only partly congruent, these decisions will result in tensions, but also in opportunities to better align the two perspectives. In the remainder of this section, the omni-channel customer journey and product flow are first described and then an overview of the key decision areas that interact with both is provided.

(i) Omni-channel customer journey (panel a). The marketing function is responsible for facilitating and managing seamless customer journeys that will result in superior customer experiences and a steady and sizeable revenue stream. In line with earlier literature, this research depicts the customer journey as a sequential process of consumer decision-making. The omni-channel nature is illustrated by the potential for channel switching across and within stages as presented in panel (a). There are many possible configurations in an omni-channel world (buy in store, home delivery; buy online, pickup in store, etc.). Not all channels are necessarily under full control of a single retailer (Baxendale, Macdonal, & Wilson, 2015); they can also be owned by third parties such as price comparison websites or third-party logistics providers.

The first two stages are *Need recognition* and *Information search*, after which consumers arrive at *Pre-purchase evaluation of the alternatives*. The fourth stage is referred to as '*Order*', which starts when a choice is made and ends by placing the order. It is followed by '*Order pickup or receipt*' which refers to when and how goods arrive at the consumer. Subsequently, after receiving the product, the customer can either start consuming it, indicated by '*Consumption*', or '*Return*' it directly upon inspection or if the good fails to meet the consumer's expectations. The final stage is '*Post-Journey Evaluation*' where the customer evaluates the choices made, i.e. the product, the retailer, the experience with the pickup/reception and, potentially, the return process. The overall evaluation will influence consumer (reviews of the) experience as reflected in the feedback loop from the final ('*Post-Journey Evaluation*') to the first ('*Need Recognition*') stage. The feedback could become input to any stage but, for the sake of simplicity, this paper only shows this feedback loop.

(ii) Product flow (panel c). The operations function is responsible for designing, managing and executing the product flow to reliably support the customer journey in a cost-efficient manner. The product flow process starts with the '*Purchase*' and '*Storage*' of goods by the retailer. Subsequently, the next steps in the product flow – '*Distribution*' and '*Last-mile delivery*' – involve moving the products from storage to the customer. Internal distribution refers to the order acceptance and the processing of the order through the delivery chain. *Last-mile delivery* refers to the collection of goods from an inventory location (a warehouse or retail store) and moving them to the customer's home. The final two stages in the product flow pertain to the handling of product returns, involving the '*Collection of returns*' and the '*Distribution of returns*'. These include activities such as preparing the product for reselling (cleaning, repackaging, etc.) and the physical transfer to inventory which may involve storage and internal distribution activities (hence the 'feedback' loops to these activities in Fig. 1). In an omni-channel context, the complexity and costs of the return process have increased substantially as consumers can select different return channels which makes it important to design efficient reverse logistics processes (De Leeuw, Minguela-Rata, Sabet, Boter, & Sigurðardóttir, 2016).

(iii) Key decisions at the marketing–operations interface (panel b). There are a set of key decisions which link to both the omni-channel customer journey and product flow, and hence contribute to the marketing–operations interface, loosely defined here as those decisions that involve or affect both the marketing and operations functions of the firm. Panel (b) summarises the most important decisions which are grouped into three sets of related decisions; (i) assortment and inventory, (ii) distribution & delivery and (iii) returns. The red bidirectional arrows indicate which stages are linked to which decision areas. Table 1 provides an overview of these decisions.

In the following three sections, each of these decision areas will be discussed based on a review of the marketing and operations literature streams.

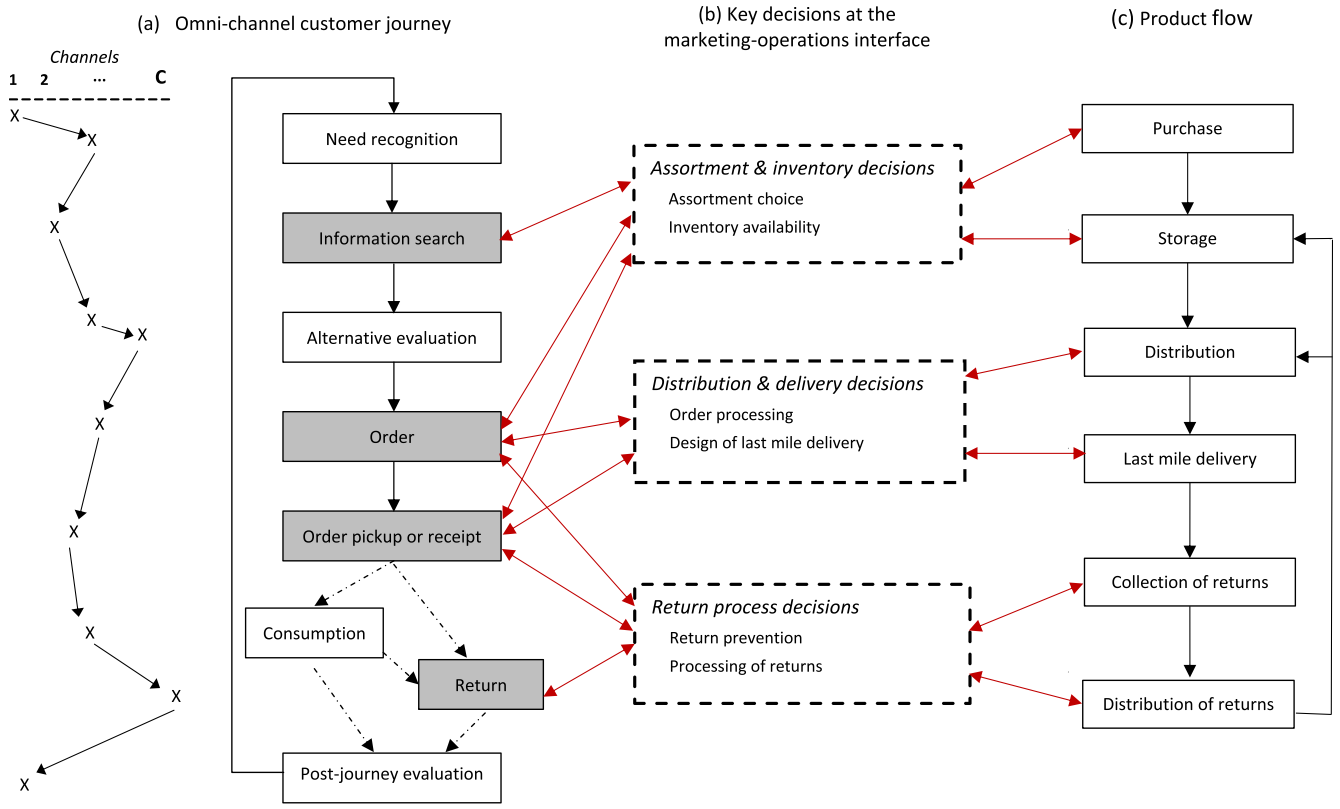

Fig. 1. Connecting the omni-channel customer journey to the product flow: Key decision areas at the marketing-operations interface. Panel (a) depicts the omni-channel customer journey: consumers migrate between channels throughout their journey, between and within stages. Panel (c) depicts the firm's product flow. The two panels are interconnected through firm decisions that affect both journey (panel (a)) and product flow (panel (c)). These decisions, indicated in panel (b), are located at the marketing-operations interface. The red bidirectional arrows indicate how the decisions interact with the customer journey on the one hand (between panel (a) and (b)) and with the product flow on the other (between panel (b) and (c)). The dotted-dash lines in panel (a) indicate that multiple paths are possible. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

3. Assortment and inventory decisions

A strategic decision for any firm is the assortment to offer to customers (Rooderkerk, Van Heerde, & Bijmolt, 2013). From a marketing perspective, the *assortment choice* (the quality and range of products that are made available) should be attractive to consumers. However, the assortment choice has a significant effect on the firm's operations. For instance, the advent of online channels has greatly increased the size of assortments (Rooderkerk & Kök, 2019), motivated by marketing objectives such as increasing sales and retention. However, large(r) assortments increase inventory costs and put pressure on the ability to provide fast and flexible delivery of the offered goods at a viable cost. In addition, large assortments may be hard to navigate for the consumer and overload them (Broniarczyk, 2008) which could result in poor choices and, consequently, higher return rates. An interrelated decision is what *inventory availability* arrangements firms should adopt. Essential decisions include inventory ownership – from supplier-owned at the supplier location(s) to firm-owned within the firm itself – and, with the latter, in which area and in what kind of channel. These decisions influence both customers service levels (e.g., delivery lead times) as well as operational complexity and costs.

As such, assortment choice and inventory availability decisions require a joint marketing–operations perspective (Hübner and Kuhn, 2012; Mou, Robb, & DeHoratius, 2018). Next, these two key decisions are discussed.

3.1. Assortment choice

Control. Traditionally, to create an attractive assortment firms would procure products from their suppliers, which they might hold in stock, and then sell them to their customers. This is referred to as the reseller model (George & Bock, 2011). Advanced information technologies and the increasing popularity of online sales have given rise to a new business model: multi-sided platforms (MSPs). In this model, firms offer a marketplace through which suppliers can directly show, sell, and deliver their products to the firm's end-customers (Van Alstyne, Parker, & Choudary, 2016), i.e. provide vendor fulfilment (Ishfaq & Raja, 2018) or drop-shipping (Cheng, Li, & Li, 2016). This implies that part of the responsibility for assortment choice is handed over to, often numerous, suppliers and that the assortment itself is constantly changing every time a supplier offers something new. The two models differ in the (dis) advantages they offer the marketing and operations functions. In particular, the MSP model may be a way to offer more variety (marketing benefit) but would come with reduced control of certain aspects of the firm's operations. To align the marketing and operations benefits, many firms decide to operate as both reseller and MSP instead of making an explicit choice in favour of either one. Moreover, under both models, retailers can gain more control over the product offerings of the manufacturers they work with. For example, Rooderkerk and Galino (2019) describe how Dutch consumer electronics reseller Coolblue and Tmall (MSP operated by Alibaba) offer exclusive products that resulted from the retailers initiating new product development at manufacturers by sharing insights into consumer preferences.

Size. From a marketing perspective it is known, and appreciated, that offering a greater product variety online gives rise to a substantial increase of consumer surplus (Brynjolfsson, Hu, & Smith, 2003) and the so-called long-tail effect (Brynjolfsson, Hu, & Simester, 2011) which describes the phenomenon that the sales of niche products increases. Increasing the assortment size could be achieved by offering more product categories (more breadth) or more products per category (more

Table 1
Interdependencies between Marketing and Operations domains in an omni-channel context.

Key decisions		Goals		Interdependencies	
		Marketing perspective	Operations perspective	Tensions	Opportunities
Assortment and inventory	Assortment choice	• Increase sales and retention • Control assortment • Large product variety • Attractive assortment for each channel • Customer convenience across channels • Limit information overload to customers • Help customers find what they need fast • Offer long-tail products • Online coverage of diverse markets (e.g. urban and rural)	• Control of suppliers and fulfilment operations • Low inventory costs • Fulfilment efficiency • Limit number of returns and associated costs	• Large assortments with a lot of suppliers increases operational complexity and costs • Sub-optimal single-channel optimisation (e.g., excessive long tail in stores vs. online) • Multiple product and market attributes with conflicting implications for Marketing and Operations (e.g. perishable niche products, rural vs urban markets)	• Collaboration on (channel-specific) new product development through data sharing between reseller/MSP and manufacturers • Use of information technology to provide product information relevant for individual customers, thereby improving decisions and reducing returns • Use of assortment personalisation and contextual strategies that consider both attractiveness to consumers and fulfilment efficiency • Integrate assortment and channel decisions to reconcile Marketing and Operations goals
	Inventory availability	• Reseller model: short and reliable delivery time; minimise lost sales due to stock-outs; customer loyalty • MSP model: offer large variety of products and service levels • Increase sales and customer retention	• Reseller model: low operational and inventory costs • MSP model: control over supply chain • Fulfilment efficiency	• Each model (reseller and MSP) has marketing and operations advantages and disadvantages which are complex to ascertain as a whole • Choice of pooled vs distributed inventory implies trade-offs between efficiency and sales/customer retention	• Choosing optimal mix of reseller and MSP models for each product category and customer segment • Balance pooled and distributed inventory in combination with internal redistribution of inventory
Distribution and delivery	Order processing	• Highly customer-friendly order systems (automated re-ordering systems, voice-assisted ordering) • Facilitating order any time, any place, any device	• Low operations costs • Build in flexibility to expand during peak demand period	• More complex (i.e., greater variety) and smaller orders • Coupling order points in the supply chain: high co-ordination costs (upstream supply chain) vs. customer convenience (downstream supply chain)	• Use of real time data to influence customer buying behaviour • Use of modern technologies in ordering process to trace product in the supply chain • Use of subscription-based delivery models that take into account both consumer preferences and logistics
	Design of last-mile delivery	• Timely, fast, and flexible delivery options • Low delivery costs • Customer convenience (choice options: cost of delivery, click-and-collect or home delivery, delivery speed, window length) • Reliable order information (track and trace) • Expanding the sales and delivery area	• Low operations costs • Sustainable supply	• Plethora of (bottom-up developed) last-mile designs facilitating customer choice at the cost of excessive complexity	• Developing an integrated view on 'who does what when' in the last-mile based on data analytics and clear design choices • Co-operate with range of stakeholders • Use of information sharing systems throughout the delivery chain • Integration of demand management and omni-channel fulfilment
Return process	Return prevention	• Increase product fit and customer satisfaction • Increase net sales • Increase post-purchase spending	• Minimise risk of retail borrowing • Minimize return incidence and operations costs	• Achieving customer satisfaction and retention without sacrificing per-customer profitability	• Use of technology such as augmented and virtual reality to reduce customer uncertainty about product fit • Use of AI to optimise individual product recommendations • Use of data analytics to discourage purchases with high return risk • Promote stores as purchasing channel (experience, service, etc.) based on accurate store-level inventory data online
	Processing of returns	• Convenient returning (any channel, hassle free) • Quick return handling and reimbursement	• Low operations costs • Cost-efficient product screening • High product salvage value	• Conflict between return convenience and return processing costs	• Promote stores as return channel • Speed up reverse logistics • Promote returned products as lower-price option • Convert planned returns to substitutions, up-sells, or cross-sells in stores

depth) (Kök, Fisher, & Vaidyanathan, 2008; Mantrala et al., 2009). More assortment breadth increases the potential for cross-selling due to customer preferences for one-stop shopping or product complementarities (e.g., pasta and pasta sauce) (Betancourt and Gautschi, 1990). More depth increases the potential for upselling, for instance by offering a larger number of premium products.

However, from an operations perspective larger assortments increase inventory costs (pure reseller model) or diminish control (MSP). Moreover, they lead to more complexity and require more co-ordination, typically with a larger set of suppliers. There are also other potential operational disadvantages from larger assortments. The wealth of product choices could lead to information overload, lowering the quality of consumers' choices, their confidence with their choice and corresponding satisfaction (Lee & Lee, 2004) which will increase returns.

Improving assortment navigability (the ease with which consumers can move around the assortment to find the information/products they are looking for) and adopting assortment customisation (adjusting assortment dimensions to personal and situational factors) are ways to align marketing and operations functions when it comes to assortment size. In terms of navigability, firms increasingly turn to technology (web, mobile) to help them offer large online assortments while ensuring similar levels of convenience and speed as in physical stores (Rooderkerk & Kök, 2019). The use of well-designed filters and other online design elements, and the adoption of voice technology, allow firms to offer large online assortments without the need for an individual consumer to fully appraise them (Baynard Institute, 2015; Kahn, 2017). As a consequence, consumers may find choosing from large physical assortments much harder than from their considerably larger online counterparts due to the absence of in-store decision aids compared to online (Rooderkerk & Kök, 2019).

Another promising development for integrating marketing and operations goals is assortment customisation, either through *personalisation* or *contextualisation*. Personalisation involves 'tailoring the composition and presentation of product and service offerings to the individual' (Rooderkerk & Kök, 2019). Contextualisation, fuelled by mobile commerce, involves 'product/service offerings tailored to the temporal and spatial context of the user' (Kenny & Marshall, 2000). However, these strategies will really have an impact when they not only consider marketing goals ('increase demand') but also consider fulfilment efficiency. For example, retailers might i) not want to recommend bulky/heavy products for home delivery to consumers living far away from the fulfilment location or ii) want to promote those products that have higher levels of inventory.

Channel-specific product range. Another major assortment choice decision is the selection of the product ranges to be offered through each channel. Channels vary in their ability to provide convenient customer access to a range of products while maintaining high levels of operational efficiency (Bell, Gallino, & Moreno, 2014; Sousa, Amorim, Rabinovich, & Soddero, 2015). For example, niche (long-tail) products are considered to be especially appropriate for selling through online channels (Brynjolfsson et al., 2011). From a marketing perspective, they benefit from the information search ability of the online channel. From an operations perspective, because these items have irregular demand, they benefit from being stocked in a centralised inventory, upstream in the supply chain, rather than in physical retail stores closer to consumers, resulting in inventory pooling benefits. In this example, marketing and operations considerations are aligned but, more generally, products have multiple attributes that carry relevant, and sometimes conflicting, implications for the two functions. For example, if a niche product is also perishable (implying higher last-mile logistics costs) and has important non-digital attributes (e.g., requiring touch/feel for assessment), then the decision to sell it online is less straightforward. In order to alleviate these tensions, retailers need to integrate assortment and channel decisions to align their marketing and operations goals. In other words, when deciding on product-channel fit they need to incorporate both objectives.

Opportunities for better alignment include selecting different channels to support the different stages of the consumer journey (e.g., showrooms for experiencing non-digital product attributes and the internet for searching products and placing orders) (Bell, Gallino, & Moreno, 2018) or selecting channel-specific assortments such that they will not compromise delivery efficiency (e.g., refrain from offering perishable products online). For example, considering potential cross-channel effects, a better integration of bricks and clicks increases the opportunity for a salesperson in a physical store to cross-sell and up-sell certain SKU's that are not carried in the store but are available online (Grewal, Levy, & Marshall, 2002). Another opportunity to balance marketing and operations objectives is to stimulate channel-specific new product development. Rooderkerk and Galino (2019) discuss how P&G designed the Tide Eco-Box, a product with less packaging and a convenient boxed design taking up less space in delivery trucks, which was designed for e-commerce specifically with the "last-mile" in mind.

Geographical reach. Another tension in assortment choice arises from the growing need to sell online to ever wider market geographies. As part of their omni-channel strategies, many retailers are expanding their online sales from densely populated urban areas to scarcely populated rural areas, sometimes to compensate for the closure of physical stores in the latter locations (Sousa, Horta, Ribeiro, & Rabinovich, forthcoming). Given that the economics of last-mile delivery are very different in sparsely populated locations, the wide assortment that retailers typically offer online in urban areas may not be economically sustainable in rural areas. Thus, in rural areas, retailers may not wish to be the "everything store" in the Amazon fashion (Stone, 2013) but rather take on a curator role, offering a smaller but more relevant assortment (e.g., those products that are not available in local stores).

3.2. Inventory availability

Ownership. In an omni-channel world, inventory availability decisions include inventory ownership and physical location across the different channels. Inventory ownership involves the choice between the reseller and the MSP models. Each model has marketing and operations advantages and disadvantages. In the reseller model, an online retailer holds its own inventory, and therefore product availability is directly affected by its own inventory policies. This favours the marketing goals of delivering quickly and minimising lost sales due to stockouts which, in turn, lead to increased customer loyalty (Rao, Griffis, & Goldsby, 2011). However, it requires the retailer to incur operational and inventory costs. In the MSP model, the availability decision is devolved to the suppliers although retailers will make agreements with suppliers about availability. This favours marketing goals in allowing online retailers to offer a large variety of products. It also provides the opportunity to make products available with a variety of service offerings from different suppliers at different prices, an approach used by Amazon among others. The resulting assortment variety that is made available at varying prices and delivery lead-times is likely to affect consumer repurchase intentions (Heim & Sinha, 2001). However, from an operations perspective, the MSP model implies dependence on suppliers (in particular OEMs) to ensure control over the supply chain.

The decision of whether to adopt the reseller or MSP model (or even a mix) is complex because not only is each of the options associated with tensions between marketing and operations goals, but also the choice of one option foregoes the marketing/operations advantages of the other option (e.g. the operations function cannot benefit simultaneously from the control of the supply chain afforded by the reseller model and the reduced inventory costs associated with the MSP model). Thus, providing guidelines to optimise the mix of business models for each product category and customer segment contributes to a better alignment between the two functions.

Location. When it comes to the location of inventory, the existence

of multiple sales and distribution channels has significant marketing and operations ramifications and adds significant complication. Relevant decisions include whether to have multiple stock points from which items are delivered to customers, which customers receive deliveries from which stock point(s) under what circumstances, and how to deal with inventory shortages across physical locations. Typically, there are tensions between marketing and operations goals associated with these decisions. A good example is how store-based retailers realign the physical distribution process when integrating an online channel into their business model. Ishfaq, Defee, Gibson, and Raja (2016) and Ishfaq and Raja (2018) found that it is more efficient to fulfil online orders using pooled inventory at distribution facilities dedicated to the online channel than from distributed inventory in stores or applying the MSP model. However, pooled inventory is less effective in promoting customer retention (Ishfaq & Raja, 2018). In addition, Gallino, Moreno, and Stamatopoulos (2017) found that the introduction of cross-channel functionalities (e.g. ship-to-store) may increase the overall sales area of retailers, albeit at the expense of inventory costs. Ishfaq and Raja (2018) indicate that store-based retailers typically evaluate inventory location options based on the least cost to serve customers and tend not to consider marketing goals.

In sum, when deciding on where to locate inventory it is important to balance marketing considerations, which benefit from more distributed inventory by increasing product availability and speed of delivery, with those of operations which favours more inventory pooling. Ultimately, it comes down to understanding how inventory location affects both profitability (short-term perspective) and customer retention (long-term perspective). In addition, internal redistribution of inventory (across or within channels) may be used to resolve inventory imbalances. The operational costs of doing so may be compensated by additional sales resulting from availability at the right time and place.

3.3. Directions for future research

Based on the discussions in the previous subsections, this paper has identified several areas for future research. Regarding *assortment choice*, more research is needed on the choice between the reseller model, MSP model or a hybrid of the two. The tension between what to control and what decisions (e.g. regarding pricing, bundling, marketing of the product and terms and conditions) to leave to suppliers is an interesting but rather unexplored area for joint marketing–operations research (Hagiu & Wright, 2015, 2019). Scholars have already examined the link between a firm's choice for the reseller or the MSP model in relation to a product's marketing activities (Hagiu & Wright, 2015), its price (Abhishek, Jerath, & Zhang, 2016) and innovative versus functional products (Zott & Amit, 2008). However, these studies have ignored the firm's experienced need to control and manage their suppliers and, as a consequence, their assortment. In addition, given the increased popularity of using both models, future research should ascertain which products to source, and sell, through each model (Hagiu & Wright, 2015), taking into account marketing and operations goals.

Another area for future research in *assortment choice* is identifying relevant product and target market attributes that have significant marketing and operations ramifications in assortment-channel decisions. For example, the literature is inconclusive about the effect of product characteristics on consumer behaviour in fulfilment processes (Nguyen et al., 2018). The resulting findings could be used to identify and classify strategies that retailers can adopt to optimise assortment-channel decisions based on both marketing and operations considerations. Next, future studies should focus on how dimensions of assortment navigability (e.g., filters, amount of information, type of information) can achieve both marketing goals (speed of buying, sales, loyalty) and operations goals (reduce returns). Moreover, future research could investigate the potential of the personalisation and contextualisation of assortment choice (e.g., offering different assortments to different customers online) and navigability (e.g., show the same assortment in different ways to different customers) to further align marketing and operations goals. Regarding *inventory availability*, future studies could shed more light on how consumer preferences related to fulfilment performance (e.g. availability, order lead-time) affect the mix of MSP and reseller models and how inventory-related decisions for these types of models are affected by consumer and product characteristics.

4. Distribution and delivery

The second decision area where marketing and operations should develop a more integrated research perspective is the distribution of retail products in an omni-channel context. Decisions such as warehouse location, inventory, capacity management, transportation, and (last-mile) delivery are important management considerations in the fulfilment process. These issues need deciding on in an integrated manner (Saghiri et al., 2017). The distribution and delivery of products to customers across different channels has to guarantee that deliveries are timely, fast, flexible and reliable in order to enhance customer satisfaction and loyalty (Semeijn, van Riel, van Birgelen, & Streukens, 2005). Basic standards, at least for part of the assortment, should include same day or ultrafast delivery, the possibility to adapt delivery agreements, and provide instant and continuously updated information during the delivery process (track and trace). At the same time, retailers aim to enlarge their sales and delivery area which acts against low distribution and delivery costs. To show the marketing-operations interface clearly, this article discusses two main key decisions: *order processing*, including the order acceptance and the processing of the order through the delivery chain, and the *design of the last-mile delivery*, referring to the movement of goods from the last transportation hub to the end customer.

4.1. Order processing

The omni-channel context has clearly changed the order processing stage. A marketing objective is to ensure the right resources are allocated to each touchpoint to maximise the probability of a purchase. Customers expect order systems to provide similar convenience levels across devices, places and times (see Table 1). The omni-channel placing of orders and innovative order systems (automated re-ordering, voice-assisted ordering) have resulted in the processing of numerous orders, very diverse orders in terms of composition and often small orders, all via multiple channels. This tremendously complicates the order processing stage and makes it quite difficult to store replenishments (Hübner, Kuhn, & Wollenburg, 2016; Melacini, Perotti, Rasini, & Tappia, 2018). Until recently, most research on order processing in an omni-channel environment has focused on the operational aims of cost efficiency and capability flexibility to respond to changes in demand. Examples include research on which replenishment policy to choose (see the review study of Melacini et al., 2018) and what kind of fulfilment strategy to apply from either channel-dedicated fulfilment centres, store fulfilment options (fulfilment of online channel through leveraging inventory in local stores), or integrated fulfilment (combining warehouse and inventory activities for fulfilment of both online and store channels) (Ishfaq & Raja, 2018; Marchet et al., 2018).

Interestingly, recent research has applied a more integrated marketing-operations approach. For instance, customers' fulfilment wishes and behaviour can be influenced by steering customers to a channel that favours logistics efficiency based on real time data. This has, for instance, been accomplished by providing different options in inventory management and offering various delivery and return options (Wollenburg, Holzapfel, Hübner, & Kuhn, 2018). A similar idea to align marketing and operations perspectives is that of offering subscriptions to customers. Subscription-based distribution services offer specific services to customers for a flat membership fee, e.g. next day delivery to a home address for free or free returns shipping. Amazon Prime and

Walmart use this model with the marketing goals of growing the customer base, locking-in customers and creating a more stable revenue stream from delivery fees. Recently, firms have started to develop more balanced approaches by setting restrictions on customer's ordering behaviour to mitigate operations costs, such as imposing minimum order values and a maximum number of orders per month. Moreover, they have targeted subscription programs more strongly to high-value customers by setting higher (more cost-effective) subscription fees, but which are still attractive to customers.

The second main issue that influences the performance of order processing in omni-channel settings is the determination of appropriate order coupling points. Customers prefer receiving their complete order in one batch, yet multiple suppliers might be responsible for delivering various parts of the order in case the MSP or hybrid model is applied. This requires co-ordination across the order process, either upstream, which implies high co-ordination costs as the provider has to collect all the items of an order, or more downstream, when, ultimately, the customer receives multiple items of an order at different timeslots and places. For instance, when e-retailers employ a hybrid business model, it is a challenge for them to determine under what conditions (fees, delivery options) the suppliers and customers should co-operate in the fulfilment process to reduce spill-over effects and meet delivery agreements (Hagiu & Wright, 2019). Furthermore, managing this complexity is a huge challenge when considering the multiple contingencies that influence a favourable fulfilment strategy from the perspective of operational costs (Ishfaq & Raja, 2018; Lim, Jin, & Srai, 2018; Marchet et al., 2018).

The tensions in order processing (Table 1) have stimulated the development of integrated and value-oriented service supply networks (He, Ho, Zhang, & Dey, 2016) where suppliers of goods and services and logistic service providers divide tasks and co-operate intensively. This demands fast, timely and accurate sharing of information and has increased the need for advanced administrative and contractual control and tracking systems. An example of digital information-sharing and utilisation is the use of sales forecasts to increase the efficiency of fulfilment operations (Van Duin, de Goffau, Wiegmans, Tavasszy, & Saes, 2016). Also, much is expected of the use of distributed ledger technology (DLT) like blockchain that could potentially facilitate interactions among organisations and individuals by providing a foundational technology in which every contract, process, payment and task has a digital record and signature that could be identified, validated, stored and shared (Iansiti & Lakhani, 2017). DLT can be used to track products in the supply chain which reduces co-ordination costs and offers a convenient way for customers to check their purchased products (Swan, 2015). However, advanced applications of DLT that co-ordinate a large number of more diverse partners to provide more novel solutions are still in their infancy (Iansiti & Lakhani, 2017).

4.2. The design of the last-mile

Last-mile delivery has become a crucial force for market differentiation and delivery innovations. Last-mile distribution is especially challenging since it can absorb 15–18% of sales revenue (Hu, 2018) and has to ensure a reliable delivery service (Rao et al., 2011) at prices that customers are willing to pay. This has resulted in an enormous diversity and complexity of last-mile delivery designs across multiple channels. On the one hand, tensions can arise between meeting the large range of customer requirements for last-mile delivery that preferably are independent of channel type and, on the other hand, a cost-efficient and sustainable delivery. From a marketing perspective, last-mile delivery plays a key role in maintaining customer satisfaction. Retailers now offer multiple options desired by consumers such as (un)attended click-and-collect and home delivery options (Agatz, Fleischmann, & Van Nunen, 2008; Gallino et al., 2017; Hübner et al., 2016; Melacini et al., 2018; Nguyen et al., 2018).

From an operations perspective, the cost-efficiency of delivering goods and the development for sustainable city logistics raise operational challenges in the design of last-mile. A systematic literature review of Ranieri, Digiesi, Silvestri, and Roccotelli (2018) discussed innovative solutions to reduce delivery costs in urban areas. These are classified into five categories: innovative vehicles, proximity stations or points, collaborative and co-operative urban logistics, optimisation of transport management and routing and innovations in public policies and infrastructures. They show how the concept of smart logistics searches for new avenues to trade off efficiency, sustainability and customer delivery requirements.

There has been heightened research attention to integrating marketing and operations perspectives regarding the last-mile delivery in an omni-channel context. Gallino et al. (2017) and Gao and Su (2017) study the impact of click-and-collect (C&C) delivery on store operations. They found that when consumers can strategically make channel choices, the C&C delivery options can help retailers to reduce inventory and expand marketing share. Bell et al. (2018) and Gao and Su (2016) show that the use of showroom stores in combination with online fulfilment can increase demand and improve operational efficiency. While these have been useful advances in light of the heterogeneous, complex and increasingly blurred landscape of delivery models, the prevailing dichotomy of the online-offline comparison seems over-simplistic.

Lim et al. (2018) distinguished between three basic forms of last-mile delivery: (a) push-centric systems that are constructed from a number of sub-processes and actors involved in the route between source and destination, such as making use of one's own vehicle fleet, outsourcing to logistic service providers or crowd-sourcing; (b) pull-centric systems that require customers to participate throughout the fulfilment process; and (c) hybrid systems that combine push and pull elements, such as developing collection delivery points where consumers can pick up their products to mitigate the risk of not being at home. To make a correct design choice for the last-mile delivery, collaboration among all the involved stakeholders should be considered to develop an integrated view on 'who does what when' in this delivery process. In particular, the role of customers in last-mile delivery deserves attention because customer participation may enhance the efficiency of the fulfilment process (Allen, Thorne, & Browne, 2007; Weltevreden & Rotem-Mindali, 2009). Customers could take over roles of third-party logistics providers and thereby experience more self-control, yet customers may also experience less convenience because of their own effort and time (Allen et al., 2007) and they might become a major source of inefficiency if they are not-at-home (Song, Guan, Cherrett, & Li, 2013).

Since multiple stakeholders are involved in last-mile delivery, the use and sharing of information throughout the delivery chain is crucial. Examples are sharing inventory information so that sales can be increased for retailers who offer a buy-online-and-pick-up-in-store option (Gallino & Moreno, 2014) and informing and making suppliers aware about how much expected delivery times influence sales. The sharing of track and trace and performance information by platform partners, which serves as input for stimulating last-mile delivery performance of partners and excluding underperformers, is also interesting. This could benefit the customer value proposition (i.e., being able to tell a customer where a product comes from) and product flow visibility which could then result in more operational efficiency.

4.3. Directions for future research

The discussion of the literature highlights two main directions for future research. First, more research into the roles, preferences and behaviour of customers in fulfilment processes is needed. Very little research has been conducted on the use of consumer service instruments to stimulate consumer behaviour that creates a better alignment between marketing and operations goals in order fulfilment. Relevant research questions would be: How to mitigate the risks of customer involvement? How to manage customers to ensure that their behaviour

is according to what is expected? How to find an optimal trade-off between providing convenience to customers and having them as co-producers and sources of cheap labour? These seem interesting avenues for further research.

Second, a major challenge for future research is the study of the antecedents and outcomes of the alternative omni-channel and last-mile delivery models. There is hardly any research on last-mile delivery that integrates the marketing and operations perspectives (e.g., how do customers value different attributes and the associated operational consequences?) An exception is the work of Sousa et al. (2016). Qualitative literature and managerial contributions highlight a number of important trade-offs in the design of multi-channel fulfilment processes (Hübner et al., 2016). Although such integration raises complexity concerns, it is believed that further analysis can reveal valuable insights and offer a comprehensive guide for practitioners.

5. Returns

The third key decision area that benefits from an integrated marketing-operations perspective is product returns. The key strategic decisions for any online retailer pertain to designing the return process and the return policy, i.e. a formal policy prescribing whether, when and how customers can return a product. Firms can choose between a more lenient or more restrictive approach. Decisions for the return policy and process need to be balanced to maximize firm profits. The marketing perspective puts the emphasis on increasing customer purchase incidence and decreasing return incidence. In contrast, the operations perspective stresses the effectiveness and efficiency associated with returns.

Product returns by customers form a major challenge and create high costs for online retailers. This is due to the extensive amount of returns and high handling costs (De Leeuw et al., 2016; Minnema, Bijmolt, Petersen, & Shulman, 2018; Ofek, Katona, & Sarvary, 2010; Shang, Pekgün, Ferguson, & Galbreth, 2017; Walsh & Möhring, 2017). In their study among online fashion retailers, De Leeuw et al. (2016) found return percentages ranging between 13% and 45%. Shang et al. (2017) estimated the value of all consumer returns received by U.S. retailers at $260.5 billion which had increased by around 50% from 2007 to 2015. With an estimated global fashion retail market of three trillion US$ and average return percentage of 25% (FashionUnited, 2016), the financial and societal consequences are immense. High product return percentages may also negatively affect sustainability of the firm, and society at large, by generating waste and requiring high additional energy resources for transportation. For example, Amazon received ample attention in the press when it allegedly destroyed large amounts of returned items in Germany (Meyer, 2018).

On-line retailers invest heavily in the management of product returns. These efforts can be split into 1) actions that reduce the likelihood of product returns by customers, mostly done as part of marketing (*return prevention*), and 2) efficiency of dealing with the actual return as part of operations management (*return processing*). Academic research is inconclusive as to how a lenient return policy needs to be designed in order to facilitate purchases while keeping returns and associated operational costs in balance. This is the main tension between the marketing and operations perspectives (De Leeuw et al., 2016; Hjort & Lantz, 2016; Janakiraman, Syrdal, & Freling, 2016).

5.1. Return prevention

The return probability is influenced by the return policy and by product and customer characteristics (see Minnema et al., 2018). The return policy is an important part of the after-sales services of online retailers that sets the conditions for the return process. Approximately 63% of consumers pay attention to a retailer's return policy before purchasing online (Rao, Rabinovich, & Raju, 2014). From a marketing perspective, a lenient return policy can mitigate perceived risk by consumers (Zhang, Yan, & Johnston, 2017) and thereby positively affect purchase behaviour. A lenient return policy makes customers more inclined to order because, if there is a product misfit, it allows for a simple return without (monetary) loss (De Leeuw et al., 2016; Gelbrich, Gäthke, & Hübner, 2017). Offering free returns will increase customer satisfaction and post-return spending by customers (Shang et al., 2017).

On the other hand, from an operations perspective, on the other hand, return leniency has serious adverse reverse logistics cost implications and complicates return processing as it increases the return rate (Oghazi, Karlsson, Hellström, & Hjort, 2018). It may also lead to fraudulent returns (Griffis, Rao, Goldsby, & Niranjan, 2012) and incentivise customers to return products shortly after use; a response termed 'retail borrowing' by Foscht, Ernstreiter, Maloles, Sinha, and Swo-boda (2013). A strict return policy decreases the return rate and cost. However, it is also likely to reduce the (re)purchase intention and has a negative impact on demand (Altug & Aydinliyim, 2016; Bonifield, Cole, & Schultz, 2010; Ofek et al., 2010; Wu & Wang, 2017).

Product and customer characteristics also influence returns. For example, items on sale are returned less often than regularly priced ones (Petersen & Kumar, 2009). Prior product evaluation also plays a role in returns. For example, a very high valence of online reviews may increase product returns as it inflates customer expectations (Minnema, Bijmolt, Gensler, & Wiesel, 2016). The probability of returns can be lowered by measures to ensure that customer expectations match their actual experiences. This can partly be remedied by the retailer providing more and more useful information about each product so that the customer can better evaluate the product before making a purchase (Altug & Aydinliyim, 2016; Wollenburg et al., 2018). Interestingly, providing customers with the ability to zoom into product pictures decreases returns, whereas using a 3D representation that allows customers to see the product from different angles increases returns (De Leeuw et al., 2016). However, providing more information can also increase uncertainty and thus returns (Shulman, Cunha, & Saint Clair, 2015). In the future, technologies like augmented and virtual reality can be an opportunity to provide a more store-like experience and reduce customer uncertainty about product fit. Regarding demographic characteristics influencing returns, on the other hand, research has found no or mixed evidence (Petersen & Kumar, 2009; Minnema et al., 2016; Minnema et al., 2018).

In general, data analytics might help to identify factors that determine returns (e.g. Griffis et al., 2012). Firms can use data analytics and Artificial Intelligence on past purchase information, combined with customer information, to identify high-return-risk customers and/or purchases. This can help discourage such purchases and lower the tensions between marketing and operations. One opportunity to reconcile these tensions is to promote stores as a purchase channel for high-return-risk purchases. Here, the chances of returns may be reduced because customers are helped in ways (i.e., better product fit) that lead to higher customer satisfaction and lower return handling costs. In a case study of a US online-first eyewear retailer opening showrooms, Bell et al. (2018) show that returns rates in the local market drop after the store opening, especially for complex items. However, stimulating online customers to visit the store for a specific item requires accurate information on store-level inventory which may be challenging to achieve (DeHoratius & Raman, 2008).

5.2. Processing of product returns

The omni-channel environment has increased the complexity of the return process as customers can choose from multiple channels at the order, fulfilment and return stages. For example, a customer may order a product online, collect the product at the store and have the product collected at home when returning the product. In addition, adding channels adds legal obligations for the retailers. For example, customers in the EU may legally return most online purchase without reason within a period of 14 days but there are no such laws for offline

purchases. Important operations considerations for the return process include the return locations, gatekeeping (at which time and how strictly the firm controls for the legitimacy of returns), and the speed of the process (De Leeuw et al., 2016) as these factors may affect sales and the cost and likelihood of returns.

It is particularly relevant to have convenient, responsive and efficient reverse logistics processes. This is because returns speed affects the market value of returned products, especially for seasonal products. In addition, longer return processes translate into more capital tied up (De Leeuw et al., 2016; Letizia, Pourakbar, & Harrison, 2018) which is particularly relevant for high-value products. Increasing return speed aligns with the marketing perspective, as customers also benefit from quicker reimbursements that result from quicker processing of returns. Furthermore, Dailey and Ülkü (2018) showed that successfully returning a product to an online retailer sets expectations for future returns and subsequent unexpectedly denied returns lead to adverse consumer behaviour (e.g. negative attitude formation, fraudulent behaviour). Therefore, return processing must also be consistent and comprehensible for customers.

In terms of location, retailers have a number of options in managing returns. Steering customers to a particular option is not only a matter of optimisation from an operations perspective but also from a marketing perspective. For example, particularly for multi-channel retailers, it can be advantageous to promote in-store returns. This ensures that products returned can be taken up in stock faster (De Leeuw et al., 2016). The marketing and operations perspective align on this issue as it is also an opportunity for generating extra sales (e.g. cross-sell or up-sell) to customers who return their purchases in a store and purchase an alternative product. Mahar and Wright (2017) also found that the majority of consumers actually preferred to return a product in-store rather than shipping it back to the retailer. In the end, a responsive reverse logistics process is associated with customer retention, positively affects order frequency and increases customer value (Minnema et al., 2018).

All products that are returned have to be screened (gatekeeping) to be able to validate them (De Leeuw et al., 2016). Screening is crucial for operations to discourage retail borrowing and from a marketing perspective to not re-sell subpar products. It has to strike a balance between thoroughness and cost-efficiency. After screening, the retailer can resell the product 'as-is', refurbish or repair it, sell the product to a third party, re-label and re-pack the product or dispose of it altogether (Letizia et al., 2018; Ofek et al., 2010). Along with these different options come different salvage values that are key determinants in deciding on a return policy. Generally, "only 10–20% of the returned product's original value can be recouped" (Ofek et al., 2010). However, re-selling returned products and promoting them as a lower-price option of the same item is an opportunity to offer an attractive assortment in a lower-price range to a specific customer segment while recouping value from the returns.

5.3. Directions for future research

Most research on product returns has focused on either prevention and drivers of returns, or on processing of returns. Minnema et al. (2018) and De Leeuw et al. (2016) provided literature reviews and research directions for both. However, as discussed above, return prevention and return processing are interrelated. Future research should examine how technology, such as virtual/augmented reality or artificial intelligence, may help in bridging the divide between returns prevention and returns processing.

Omni-channel retailers can offer a variety of return channels (see Fig. 1). From a marketing point of view this is attractive as it may offer opportunities for cross-selling or up-selling. Also, firms may exploit the idea that customers can search for information across channels, e.g. by performing showrooming and webrooming (Bell et al., 2018) or checking on-line reviews while being at the store and providing more and better information across channels so as to lower return probabilities. Physical stores opened up by on-line retailers, e.g. by online fashion retailer Zalando and the Dutch on-line retailer Coolblue, may play an important role at this stage too. To date, little or no research is available on the role of stores in these cross-channels challenges and opportunities related to product returns. This is a second area of future research.

A third research area relates to the optimisation of returns processing, both for collection of returns as well as distribution of returns (as shown in panel (c) in Fig. 1). Regarding the former, when collecting returns from customer addresses it is essential to understand how these returns can be integrated effectively and efficiently in existing transport networks such as the networks used for product delivery. Regarding distribution of returns, future research could investigate the opportunities and risks of re-selling previously returned products as well as the channels through which these are sold. One the one hand, it is an opportunity to offer a lower-price option to a specific customer segment while recouping more value from the returns than selling returns to third parties or via specialised outlet channels. Some retailers offer returned items directly next to the new items as 'second chance' items with a lower price in an attempt to valorise their returns. On the other hand, it may also lead customers to buy the returned item at a lower price even though they were initially interested in buying a non-returned full-price item.

Furthermore, the optimal design of a return process is likely to differ depending on customer and product characteristics. This is a fourth area of future research that is highly relevant to omni-channel retailers with a broad assortment serving a large variety of customers. Ruiz-Benitez et al. (2014) found, for example, that decentralised gatekeeping is particularly well-suited to the fashion sector since one can quickly spot defects with minimum training. However, this model may not work for electronics which are more difficult to inspect. Speeding up the returns process may be more relevant for high-value purchases than for low-value purchases.

6. Conclusion

In an increasingly omni-channel world, many important interdependencies exist across the stages in the customer journey (demand-side) and the product flow (supply-side), creating significant challenges and opportunities for firms. This article sheds light on the many ways an integrated marketing-operations perspective can be shaped to deal with these interdependencies. Specifically, it developed an integrative framework that identifies and addresses the interdependencies that arise in three key design decision areas: (i) assortment & inventory, (ii) distribution & delivery and (iii) returns. For each of the areas, this paper identifies the main goals from both a marketing and operations perspective point out tensions that can arise when the goals of the marketing and operations functions are not well aligned, as well as opportunities to mitigate these tensions and directions for future research.

This article offers both academic and practical implications. From an academic perspective, the paper provides a new framework and valuable guide to analyse existing research in omni-channel retailing, highlighting gaps for future work in this nascent field. While some recent studies have incorporated both the marketing and the operations perspective (e.g. Bell et al., 2018; Gallino, Moreno, & Rooderkerk, 2019; Sousa & Amorim, 2018; Wollenburg et al., 2018), more studies should explicitly address these two perspectives in an integrated manner. Drawing on the framework detailed here, future research should assist firms in finding avenues that lead to net gains when factoring in both demand and supply side (dis)advantages. From a practical viewpoint, the paper provides a systematic analysis of the main interdependencies between omni-channel customer journeys and product flows, together with associated tensions and opportunities. Firms may use this framework to mitigate tensions, leverage opportunities and make coherent marketing and operational decisions when (re) shaping their own business models to better fit the omni-channel environment.

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