Designing logistics in omni-channel retailing: drivers behind company distribution configurations

Melacini M.*, Perotti S.*, Rasini M.*, Tappia E.*

* *Department of Management, Economics and Industrial Engineering, Politecnico di Milano, Via Lambruschini 4/B, 20156 - Milano – Italy (marco.melacini@polimi.it, sara.perotti@polimi.it, monica.rasini@polimi.it, elena.tappia@polimi.it)*

Abstract: Traditional retail is experiencing a phase of substantial changes. As the line between online and traditional channels is blurred, a new approach is emerging, named omni-channel (OC), which aims to offer a seamless customer experience regardless the channel(s) used. For traditional retailers, the adoption of an OC approach means creating new distribution configurations, where the key design variable is the integration between online and traditional channels. Retailers may use their existing resources (e.g. facilities, personnel) for serving both traditional and online customers or else opt for resources dedicated to the new channel (e.g. new distribution centres specifically designed for the online channel or dedicated personnel for online order fulfilment). Despite the rising debate in the practitioners' community, this issue is still under-represented in the academic literature. The purpose of this paper is to investigate the distribution configurations adopted in OC retailing by exploring the factors driving the company decisions in terms of logistics integration between the online and traditional channel. The research was structured into two main steps. The first involved a thorough review of the literature to both identify contextual and logistics variables and formulate propositions describing the relationship among them. Second, a survey research targeting OC retailers operating in Italy was conducted. The survey offered insights on the distribution configurations adopted and allowed to check whether and how the theoretical propositions were supported. Results confirmed that when companies re-design their distribution configurations looking for an OC approach, many choices depend on service- and operational-specific factors. Summarising, the service-specific factors drive the decision on the picking location, whereas the online sales volume the integration between the online and traditional channel in terms of personnel for the order picking and inventory. Furthermore, the assortment width emerges as a key driver in the dynamic allocation policy implementation.

Keywords: Omni-channel retailing, logistics, distribution configuration, empirical research.

1. Introduction

Traditional retail is experiencing a phase of substantial changes. While online retailing is not a new phenomenon, the increasing convergence of traditional and online retailing is leading to a new phase, named omni-channel (OC), which aims to offer a seamless customer experience regardless the channel(s) used (Piotrowicz and Cuthberts, 2014; Verhoef et al., 2015). This approach introduces new challenges for retailers that, with a view to offering customers a seamless shopping experience across all retail formats, are moving towards integrating processes, information systems, inventories and performance measurement systems that are typically managed as distinct entities within a multi-channel (MC) proposition (Bernon et al., 2016).

From a logistics viewpoint, retailers willing to adopt an OC approach need to re-design their distribution configurations, deciding whether and how to integrate the online orders in the traditional operational processes (Hübner et al., 2015). Retailers may use their existing resources (e.g. facilities, personnel) for serving both traditional and online customers or else opt for resources dedicated to the new channel (e.g. new distribution centres specifically designed for the online channel or dedicated personnel for picking activities).

OC retailing promises to be a stimulating research stream for the years to come (Verhoef et al., 2015). A growing body of research analyses the different solutions that retailers may adopt when re-designing their distribution configuration in shifting from MC to OC approach (e.g. Bernon et al., 2016; Hübner et al., 2016b). However, it is still not clear under what circumstances those different solutions perform better.

In this paper, we investigate the distribution configurations adopted in OC retailing by exploring the factors driving the company decisions in terms of logistics integration between the online and traditional channel. Specifically, by means of a survey targeting OC retailers operating in Italy, we analyse the relationship between the three following constructs: operational complexity, delivery service and distribution configuration. Operational complexity – measured through the number of orders per week and the assortment width – and delivery service – measured through the delivery mode and the velocity – are the independent constructs. Distribution configuration – that we describe in terms of picking location, picking integration, inventory pooling and allocation policy – is the dependent construct. Such constructs are based on our literature analysis as illustrated in the next sections.

The remainder of this paper is organised as follows. In the next section, we discuss the significant literature on the topic. Section 3 describes the methodology adopted. In Section 4 we illustrate the research model, including the identified theoretical propositions, whereas in Section 5 we present the main results. We conclude the paper in Section 6 discussing our findings and proposing directions for further research.

2. Literature

The aim of this research is to investigate the distribution configurations adopted in OC retailing by exploring the factors driving the company decisions. This section will therefore summarise the contributions related to logistics design in OC retailing, with particular emphasis on the possible drivers behind the company choices.

In this field, a first research stream focuses on the picking location to be used for serving online demand. Many contributions compare two alternative configurations, namely store-based and warehouse-based – central warehouse supplying also traditional stores or separated fulfilment centre – (Hübner et al., 2016b). In this regard, De Koster (2003) suggests that the decision of whether to use stores or warehouses is related to online market size, as well as the investment capacity. Similarly, Bendoly et al. (2007) demonstrate that a threshold exists, as a percentage of total demand related to the online channel, over which a dedicated warehouse results the best solution. Other significant drivers are the correlation between online and traditional demands (Alptekinoğlu and Tang, 2005) and transport costs (Liu et al., 2010). Also products characteristics may affect the picking location selection. Focusing on the grocery industry, De Koster (2002) empirically shows that traditional retailers mainly use their existing infrastructures to fulfil online demand; Mangiaracina and Melacini (2013) show that the warehouse-based solution seems to be more suitable than the store-based approach from an economic point of view. Looking at the delivery service, Hübner et al. (2016b) argue that fast deliveries require to set the picking location very close to the customer, whereas Hübner et al. (2016a) suggest that using a store-based solution to fulfil online orders with in-store pickup allows lower transport costs.

Besides identifying the picking location for serving the online orders, the retailer has to decide between shared or dedicated resources. The picking activity can be separated, integrated or, at a last step, capacity optimised and integrated – i.e. capacities are balanced, risks pooled, as well as stock-outs and lead-times reduced – (Hübner et al., 2016b). In this regard, Fernie and McKinnon (2009) suggest that as long as online sales are low, the retailer can easily integrate online orders in the traditional operational processes; their increase requires the introduction of new resources dedicated to the online channel. Focusing on the store-based approach, Ishfaq et al. (2016) argue that having personnel and space capacity not completely used is necessary to integrate online orders in traditional store processes.

Other academic contributions concentrate on inventory management with multiple channels. According to Hübner et al. (2016c) MC retailers have channel-separated inventories, whereas OC retailers manage integrated inventory for serving different channels. Many studies analyse the inventory pooling effects (e.g. Chiang and Monahan, 2005; Bendoly et al., 2007). Looking at the drivers behind this decision, Bendoly et al. (2007) demonstrate that the benefits of inventory pooling are related to the proportion of online sales out of the total sales, as well as the amount of demand per retail store. Liu et al. (2010) suggest that also the online demand variability represents a critical factor in determining the distribution configuration. Similarly, Bretthauer et al. (2010) show that higher online demand variability leads to fewer e-fulfillment sites because of the increased potential benefits from pooling online inventories.

Once defined how to handle online orders, another important decision is how often the fulfilment decisions take place. The location responsible to fulfil online orders can be pre-specified for each region – namely static allocation policy – or can be dynamically determined for each incoming order – dynamic allocation policy – (Mahar and Write, 2009). Mahar and Write (2009) identify the number of allocations made during each period and the fraction of total sales coming from the online channel as relevant drivers of allocation policy selection. In a related study, Mahar et al. (2012) show that the percentage of pickup sales and customers' sensitivity to travel are critical in determining benefits of the dynamic allocation policy.

To conclude, the literature reveals that logistics design in OC retailing is a promising research stream. Retailers willing to adopt an OC approach need to re-design their distribution configurations, deciding whether and how to integrate online orders in traditional operational processes. While many studies concentrate on the identification of the possible solutions available to fulfil online orders, still little research has been carried out on the relationship between the drivers and the distribution configurations.

3. Methodology

To address the aim of this research, i.e. to investigate factors driving the re-design of the company distribution configuration toward OC retailing, the work was structured into two main steps.

First, a thorough review of the literature was conducted in order to identify both the main logistics issues faced by OC retailers and the possible drivers behind the company choices. Based on this analysis, a model was developed by structuring the significant logistics variables and the related drivers into dependent and independent constructs. Specifically, we identified three relevant constructs (i.e. distribution configuration, operational complexity and delivery service), each measured through multiple variables. Propositions describing the relationship among independent and dependent variables were further formulated.

Second, a survey targeting OC retailers operating in Italy was performed with the aim of both offering insights on the distribution configurations adopted and checking whether and how the theoretical propositions were supported. We considered large companies (revenue threshold over 100 million €), with e-commerce operations belonging to different business sectors such as do-it-yourself, electronics, furniture and grocery. As a company may have multiple operational processes to fulfil online orders, the unit of analysis was the single distribution configuration. Data were collected through two main sources: interviews conducted with both retailers operating in an OC environment (8) and their logistics service providers (10); analysis of secondary sources (e.g. websites, company reports). Overall, 36 companies were analysed, for a total of 56 distribution configurations. Table 1 and Table 2 present an overview of the sample in terms of size and business sector, respectively. Confidentiality was guaranteed due to the sensitive nature of the topic, thus neither companies nor individuals are revealed.

Table 1: Description of the sample: company size.

Annual revenues [mln €]	% companies
100 – 250	38.9
250 – 500	16.7
500 – 1.000	8.3
1,000 – 1,500	16.7
> 1,500	19.4
Total	100.0

Table 2: Description of the sample: company business sector.

Business sector	% companies
Do-it-yourself	19.4
Electronics	19.4
Furniture	13.9
Grocery	38.9
Large department stores and sportswear	8.4
Total	100.0

After collection, data were examined and statistical analyses were conducted to check the validity of the propositions. First, some chi-square tests for association between dependent and independent variables were carried out. Furthermore, descriptive and cross-table analyses were performed to investigate the significant relationship. All relationship considered were assessed individually. The results of these analyses are presented and discussed in Section 5.

4. Research model

This section illustrates the research model and the propositions formulated starting from the previous literature (Figure 1). The model structure is as follows. The dependent construct is the "distribution configuration", which is split in four different variables, i.e. picking location, picking integration, inventory pooling and allocation policy. As independent constructs, we consider both "operational complexity" and "delivery service" as suggested by De Koster (2003). Note that we excluded variables for which it was not possible to introduce measurements or to obtain information for all the analysed companies (e.g. investment capacity, demand variability). For each considered variable, we introduced a binary indicator. The choice of using two categories per indicator reduces the probability of having empty categories (De Koster, 2003).

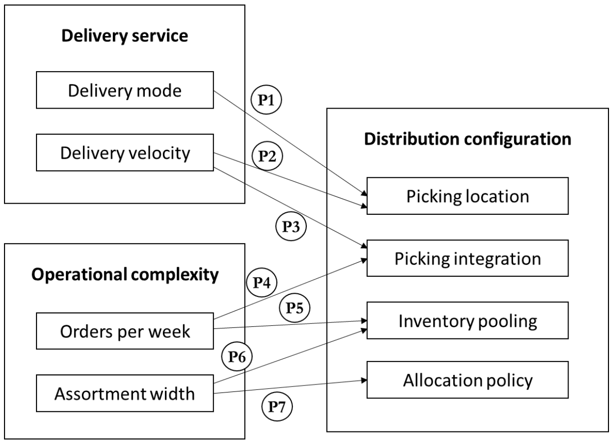

Figure 1: The research model adopted.

In the reminder of this section, the variables included in the research model are illustrated and the propositions concerning the relations among them are presented.

4.1 Distribution configuration

As stated, the distribution configuration is split in four different variables:

- *Picking location*, i.e. the type of facility in charge of the online orders. It can be a warehouse, i.e. central warehouse also supplying traditional channel or dedicated warehouse specifically designed to fulfil online orders (value 0), or store (value 1).
- *Picking integration*. It refers to the picking activity for online and traditional orders. Indeed, a company can use dedicated resources, specifically personnel, to fulfil online orders, or else integrate online orders with the picking process of traditional stores. The indicator has value equal to 1 if the picking activity is integrated, 0 otherwise.
- *Inventory pooling*. It concerns the use of shared (value 1) or dedicated (value 0) inventory for serving different channels. Sharing inventories can produce important cost savings, but it can also result in acute on-shelf availability difficulties (Fernie and Grant, 2008).
- *Allocation policy*, i.e. the policy used to allocate the online orders to the picking locations. The picking

location for serving online orders can be defined *a priori* or dynamically for each incoming order. Value 1 means that the allocation policy is dynamic, while 0 denotes a static policy.

4.2 Delivery service

The delivery service can be described in terms of delivery mode and delivery velocity.

Delivery mode.

This variable specifies the collection point for online orders. Aligned to the extant literature (Lang and Bressolles, 2013; Hübner et al., 2016c), retailers can decide between two main options: home delivery (HD) and click-and-collect (C&C), i.e. the customer places an order online and pick it up at a specific location such as a store or a locker. The delivery mode preference is mainly a matter of customer's attitude and pick-up point diffusion and accessibility (e.g. Nilsson et al. 2015). The indicator has value 1 for the C&C option, 0 for the HD.

Regarding possible relationship between delivery mode and distribution configuration decisions, we can expect that online orders with in-store pickup are directly handled in-store. In this way, the retailer doesn't have to manage frequent small dispatches from the warehouse to the store based on the online demand, but online orders are immediately available at the store to be collected by the customers (e.g. Hübner et al 2016a). This leads to the following proposition:

P1. *Retailers offering a C&C service mainly use existing stores as picking location.*

Delivery velocity.

It defines the speed offered to customers for delivering their online orders. In line with previous contributions (Hübner et al 2016b), the options can be same day, next day and two or more days. Retailers often offer customers to select the delivery velocity, where shorter delivery lead-times are more expensive (De Koster, 2003). In our model, the delivery can be fast (value 1, one of the possible customer options is within 48 hours) or slow (value 0, longer than 48 hours).

The delivery velocity can be a driver behind the company choices. First, a short lead-time to fulfil and deliver an order implies to set the picking location very close to customers (Hübner et al., 2016b). Furthermore, it is reasonable to assume that the delivery velocity has an impact on the choice of integrating online orders into the picking processes of regular stores. The use of dedicated personnel allows reducing the preparation time and, thus, guarantees fast deliveries. Consequently, we formulate the following propositions:

P2. *Retailers offering fast deliveries mainly use existing stores as picking location.*

P3. *Retailers offering fast deliveries mainly use separated personnel to handle online orders.*

4.3 Operational complexity

Regarding the operational complexity, two key variables are the number of orders per week and the assortment width.

Number of orders per week.

The percentage of company demand occurring online is a key element in determining the complexity of the operational processes. The increase in the number of online orders implies more operational criticalities. In line with De Koster (2002), the number of orders per week can be small (value 0, less than 1,000 orders per week) or large (value 1, larger than 1,000 orders per week). Although this number may seem relatively small at a first sight, it is aligned to the Italian context.

As shown in the literature review, many researches identify the sales volume as a relevant factor in determining the distribution configuration. As long as the online channel represents a small percentage of total sales, integrating online orders in the traditional processes (i.e. using picking integration and inventory pooling) seems to be the most suitable solution, easier to handle, less costly and with higher service level (e.g. possibility of offering full offline product range) (De Koster, 2003; Hübner et al., 2016b). However, when the number of online orders increases, the efficiency of an integrated solution decreases so that it is probably more cost-effective to have resources dedicated to the online channel (De Koster, 2003; Bendoly et al., 2007). For instance, dedicated personnel may allow increasing both productivity and service level when the online sales justify this solution. This leads to the following propositions:

P4. *Retailers with a large number of online orders mainly use separated personnel to handle online orders.*

P5. *Retailers with a small number of online orders mainly use inventory pooling.*

Assortment width.

The assortment width can be more or less deep. The higher the number of products in the assortment, the more difficult the process management becomes (De Koster, 2003). Differently from De Koster (2002) who considers 5,000 products as a threshold for food retailers, we set this threshold equal to 10,000 products because of the industries included in our analysis. This means that the indicator has value 0 in case of less than 10,000 products and value 1 otherwise.

According to Hübner et al. (2016c), retailers offer a limited set of products online in a basic MC approach and advance toward a more extensive assortment online than offline in the case of OC. A wide assortment, together with the need for sufficient stock in each picking location, may lead to use traditional inventories for serving also online demand. Additionally, the inventory can be stored in multiple locations (e.g. both distribution centre and stores). In this case, the retailer may dynamically define the online fulfilment responsibilities, selecting for each incoming order the facility with the availability of the products required by the online customer. The associated propositions are:

P6. *Retailers with a wide assortment mainly use inventory pooling.*

P7. *Retailers with a wide assortment mainly use a dynamic allocation policy.*

5. Results

In this section, we present the results obtained through chi-square tests and cross-table analyses and discuss the validity of the theoretical propositions formulated in the previous section. Relationship between dependent and independent variables were analysed using the chi-square test for independence, and a significant level of 5% was considered to reject or accept the propositions. These analyses were performed using Minitab. Results, structured according to the independent variable, are reported in Tables 3-6.

Regarding the delivery mode (see Table 3), results obtained support proposition P1 (χ^2=5.606, p-value=0.018). Retailers offering the C&C as delivery service mainly use existing stores to fulfil online orders, rather than reviewing the warehouse operational processes and setting up transport flows from the central warehouse to the pick-up points. In addition, in case of home deliveries companies prefer not to make use of traditional stores (16.1% of the distribution configurations in the sample). The online order is picked and packed at the central warehouse that, in turn, represents the starting point for the home delivery, typically performed by couriers (37.5%).

Table 3: Cross table of delivery mode and picking location.

	Picking location	
	0 (55.4)	1 (44.6)
Delivery mode		
0 (53.6)	+ (37.5)	- (16.1)
1 (46.4)	- (17.9)	+ (28.5)

Note: The numbers in brackets indicate the observed percentage of configurations. A '+' (or '-'/'0') means that the number of observations is more (or less/about equal) than expected.

From Table 4, we observe that the picking location selection is also strongly driven by the delivery velocity offered to online customers (χ^2=25.631, p-value=0.000). When the delivery lead-time is short (within 48 hours), companies, as attempt to be as close as possible to the final consumer, use the urban stores (37.5%), rather than the sub-urban warehouses (8.9%) as picking location. The opposite is also true: when the delivery is not extremely fast, the company does not have the need to get close to the final market and mainly uses the warehouse for serving online orders (46.4%). This supports proposition P2.

The association between delivery velocity and picking integration is only weakly significant (χ^2=1.063, p-value =0.303). Therefore, we cannot state that P3 is supported by the results found. Further research is necessary here.

Table 4: Cross table of delivery velocity and picking location, picking integration.

	Picking location		*Picking integration*	
	0 (55.4)	1 (44.6)	0 (33.9)	1 (66.1)
Delivery velocity				
0 (53.6)	+ (46.4)	- (7.2)	0 (21.4)	0 (32.2)
1 (46.4)	- (8.9)	+ (37.5)	0 (12.5)	0 (33.9)

Note: The numbers in brackets indicate the observed percentage of configurations. A '+' (or '-'/'0') means that the number of observations is more (or less/about equal) than expected.

Table 5 confirms that, in line with the extant literature (e.g. De Koster, 2003; Bendoly et al., 2007; Hübner et al., 2016b), the number of online orders represents a key factor in determining the distribution configuration. First, the number of orders per week affects the choice of either integrating online orders in the picking process of the regular stores or introducing dedicated personnel for the new channel (χ^2=5.127, p-value=0.024). When the online demand is small, integration seems to be the most suitable solution (60.7% versus 23.2% of the distribution configurations): managing online and traditional orders together, the existing personnel can be used in a more productive and effective way. The increase in the online demand results in the need of personnel specifically dedicated to handle online orders.

The association between orders per week and inventory pooling is also significant (χ^2=4.179, p-value=0.041). The inventory pooling is the preferred solution until the number of online orders is small (71.4% versus 12.5% of the distribution configurations). This solution allows obtaining synergies among channels, producing important cost savings (e.g. safety stock reduction).

Table 5: Cross table of orders per week and picking integration, inventory pooling.

	Picking integration		*Inventory pooling*	
	0 (33.9)	1 (66.1)	0 (19.6)	1 (80.4)
Orders per week				
0 (83.9)	- (23.2)	+ (60.7)	- (12.5)	+ (71.4)
1 (16.1)	+ (10.7)	- (5.4)	+ (7.2)	- (8.9)

Note: The numbers in brackets indicate the observed percentage of configurations. A '+' (or '-'/'0') means that the number of observations is more (or less/about equal) than expected.

Finally, in Table 6 the results of the associations between the assortment width and the distribution configuration choices are illustrated. The relationship between assortment width and inventory pooling is only weakly significant (χ^2=1.671, p-value=0.196). This means that the assortment width by itself does not determine the company choice of shared or dedicated inventories.

The association between assortment width and allocation policy is stronger (χ^2=8.695, p-value=0.003). While companies with a small assortment offered in the online channel, mainly opt for a static allocation policy (50.0% versus 5.4% of the distribution configurations), a deeper assortment leads retailers to adopt a dynamic allocation policy. This solution allows selecting, on a case-by-case basis, the location where the requested products are available.

Table 6: Cross table of assortment width and inventory pooling, allocation policy.

	Inventory pooling		*Allocation policy*	
	0 (19.6)	1 (80.4)	0 (75.0)	1 (25.0)
Assortment width				
0 (55.4)	0 (14.3)	0 (41.1)	+ (50.0)	- (5.4)
1 (44.6)	0 (5.3)	0 (39.3)	- (25.0)	+ (19.6)

Note: The numbers in brackets indicate the observed percentage of configurations. A '+' (or '-'/'0') means that the number of observations is more (or less/about equal) than expected.

To conclude, most propositions are supported. Only propositions P3 and P6 are rejected. This shows that, when companies re-design their distribution configurations in shifting from MC to OC, many choices depend on service- and operational-specific factors. In particular, the delivery service offered in terms of both delivery mode and velocity determines the picking location selection. Regarding the operational complexity, the number of online orders is associated with the choice of integrating online orders in traditional processes (i.e. picking integration and inventory pooling). While a wide assortment width yields to select a dynamic allocation policy.

6. Conclusions

The present research provides some insights into how companies moving from MC to OC re-design their distribution configurations. More in detail, we investigated the relationship between the company operational complexity, the delivery service and the distribution configuration used for the fulfilment of online orders.

Starting from the previous literature, we identified four key variables in describing the distribution configuration adopted to serve the online channel, i.e. picking location, picking integration, inventory pooling and allocation policy. Furthermore, the literature review suggested two relevant contextual elements behind the company distribution configurations, i.e. delivery service (measured through delivery mode and velocity) and operational complexity (measured through number of orders per week and assortment width). This led us to the development of the research model presented in section 4, including seven propositions about possible relationship among independent and dependent variables. Then, a survey research targeting OC retailers operating in Italy was conducted and some chi-square tests and cross-table analyses were performed in order to check whether and how the theoretical propositions were supported.

Results showed that when companies re-design their distribution configurations looking for an OC approach, many choices depend on service- and operational-specific factors.

The service-specific factors drive the decision on the picking location. For instance, for the C&C service and for fast deliveries (i.e. within 48 hours) companies mainly use traditional stores to fulfil also the online demand, rather than organise frequent small dispatches from the sub-urban warehouse to the urban store.

The operational complexity is instead associated to the choice of integrating online orders in traditional processes or introducing dedicated resources. Low operational complexity in terms of number of online orders per week allows integrating online orders in traditional processes, obtaining important synergies and cost savings. The increase in the number of online orders implies the need for introducing picking and packing processes specifically designed for the new channel, with dedicated personnel and inventories.

Finally, a wide assortment often drives companies from a static to a dynamic allocation policy. Defining dynamically the picking location for each incoming order allows selecting the most suitable location in which the required products are still available.

Results present both academic and practical implications. From an academic viewpoint, the present study contributes to the emerging research stream of logistics design in OC retailing by highlighting how some relevant factors affect the distribution configuration setting. Results are also useful for companies when adding the online channel to their traditional business in order to properly re-structure their distribution configurations. Retailers willing to adopt an OC approach can gain useful insights into how to develop their systems, e.g. to correctly align their distribution configuration to their operational context requirements.

The main limitation of the present study lies in the sample size. We focused on large companies (annual revenues over 100 million €), operating in Italy and belonging to a limited number of business sectors (i.e. do-it-yourself, electronics, furniture, grocery, large department stores and sportswear). It may be interesting to repeat the research with a larger sample that covers multiple countries, more business sectors, and includes small companies.

Furthermore, several potential important factors have not been included in the research model adopted (because of lack of information). Further research could analyse the impact of the traditional distribution channel (e.g. number of stores) or of the product-specific characteristics (e.g. size, value density) on the distribution configuration choices. In addition, other logistics issues related to the development of an OC system could be analysed. For instance, in line with De Koster et al. (2003), different logistics outsourcing solutions could be investigated, and it could be worth understanding how the adoption of new automated technologies such as autonomous vehicle-based systems (e.g. Tappia et al., 2015) is affected by the introduction of online order fulfilment. Finally, the performance of multiple distribution configurations could be further assessed and compared. In this line, it could be interesting, firstly, to investigate performance differences among companies both within a sector and with a cross-sector perspective and, secondly, to analyse the evolution of company distribution configuration choices and the related performance over time.

References

Alptekino□lu, A. and Tang, C. S. (2005). A model for analyzing multi-channel distribution systems. *European Journal of Operational Research*, 163 (3), 802-82.

Bendoly, E., Blocher, D., Bretthauer, K. M. and Venkataramanan, M. A. (2007). Service and cost benefits through clicks-and-mortar integration: Implications for the centralization/decentralization debate. *European Journal of Operational Research*, 180 (1), 426-442.

Bernon, M., Cullen, J. and Gorst, J. (2016). Online retail returns management: Integration within an omni-channel distribution context. *International Journal of Physical Distribution and Logistics Management*, 46 (6/7).

Bretthauer, K. M., Mahar, S. and Venakataramanan, M. A. (2010). Inventory and distribution strategies for retail/e-tail organizations. *Computers and Industrial Engineering*, 58 (1), 119-132.

Chiang, W. Y. K. and Monahan, G. E. (2005). Managing inventories in a two-echelon dual-channel supply chain. *European Journal of Operational Research*, 162 (2), 325-341.

De Koster, R. B. M. (2002). Distribution structures for food home shopping. *International Journal of Physical Distribution and Logistics Management*, 32 (5), 362 – 380.

De Koster, R. B. M. (2003). Distribution strategies for online retailers. *IEEE Transactions on Engineering Management*, 50 (4), 448-457.

Fernie, J. and Grant, D. B. (2008). On-shelf availability: the case of a UK grocery retailer. *The International Journal of Logistics Management*, 19 (3), 293-308.

Fernie J. and McKinnon A. (2009). *The development of e-tail logistics*. cap 10, Kogan page.

Hübner, A., Holzapfel, A. and Kuhn, H. (2015). Operations management in multi-channel retailing: an exploratory study. *Operations Management Research*, 8 (3), 84-100.

Hübner, A., Holzapfel, A. and Kuhn, H. (2016a). Distribution systems in omni-channel retailing. *Business Research*, 1-42.

Hübner, A., Kuhn, H. and Wollenburg, J. (2016b). Last mile fulfilment and distribution in omni-channel grocery retailing: A strategic planning framework. *International Journal of Retail and Distribution Management*, 44 (3), 228-247.

Hübner, A., Wollenburg, J. and Holzapfel, A. (2016c). Retail logistics in the transition from multi-channel to omni-channel. *International Journal of Physical Distribution and Logistics Management*, 46 (6/7).

Ishfaq, R., Defee, C., Gibson, B. J. and Raja, U. (2016). Realignment of the physical distribution process in omni-channel fulfilment. *International Journal of Physical Distribution and Logistics Management*, 46 (6/7), 543 – 561.

Lang, G. and Bressolles, G. (2013). Economic performance and customer expectation in e-fulfillment systems: A multi-channel retailer perspective. *Supply Chain Forum: An International Journal*, 14 (1), 16-26.

Liu, K., Zhou, Y. and Zhang, Z. (2010). Capacitated location model with online demand pooling in a multi-channel supply chain. *European Journal of Operational Research*, 207 (1), 218-231.

Mangiaracina, R. and Melacini, M. (2013). E-commerce in the Grocery Industry: an Assessment of Distribution Strategies. *Global Journal on Technology*, (3).

Mahar, S. and Wright, P. D. (2009). The value of postponing online fulfillment decisions in multi-channel retail/e-tail organizations. *Computers and Operations Research*, 36 (11), 3061-3072.

Mahar, S., Salzarulo, P. A. and Wright, P. D. (2012). Using online pickup site inclusion policies to manage demand in retail/E-tail organizations. *Computers and Operations Research*, 39 (5), 991-999.

Nilsson, E., Gärling, T., Marell, A. and Nordvall, A. C. (2015). Importance ratings of grocery store attributes. *International Journal of Retail & Distribution Management*, 43 (1), 63-91.

Piotrowicz, W. and Cuthbertson, R. (2014). Introduction to the special issue information technology in retail: toward omnichannel retailing. *International Journal of Electronic Commerce*, 18 (4), 5-16.

Tappia, E., Melacini, M., Marchet, G. and Perotti, S. (2015). Incorporating the Environmental Dimension in the Assessment of Automated Warehouses, *Production Planning and Control: The Management of Operations*, 26(10), 824-838.

Verhoef, P. C., Kannan, P. K. and Inman, J. J. (2015). From multi-channel retailing to omni-channel retailing: introduction to the special issue on multi-channel retailing. *Journal of Retailing*, 91(2), 174-181.