

THE IMPACT OF B2C COMMERCE ON TRADITIONAL B2B WAREHOUSING

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PURPOSE

With the emergence of electronic commerce, traditional warehousing companies are increasingly required to offer services to clients doing B2C commerce. This challenges both existing operations and information systems as they are often designed to support more traditional B2B commerce. As a result, it is important for warehousing companies to understand the special requirements of B2C commerce in order to appropriately design and adapt their operations. In this paper we study this issue and propose a model for examining the similarities and differences between B2B and B2C warehousing.

DESIGN

A two-stage methodology is used in this study. We first develop a theoretical model based on existing literature, to examine the similarities and differences between B2B and B2C warehousing. In the second stage, the model is used to study the impact of B2B and B2C commerce on key warehousing operations (i.e. receiving, storing, picking, shipping, other value-added services) and on supportive activities (e.g. performance evaluation, technology and equipment). In order to study this impact, data is collected using two research methods –practitioner interviews and direct observations at a case company offering both B2B and B2C offering.

FINDINGS

This study highlights the different requirements and needs B2B and B2C commerce have in terms of warehousing services. It shows how the different nature of B2B and B2C commerce affects different elements of warehousing. It also illustrates the fact that operations and information systems designed for B2B warehousing are not always suitable for B2C.

VALUE

Existing frameworks and tools for warehouse design and management do not recognise the differences between B2B and B2C warehousing. Moreover, the model proposed in this paper itself can be used as a tool for studying specific B2B and B2C projects and examining how existing operations have to adapt to satisfy them.

RESEARCH IMPLICATIONS

This research study opens up a new area of investigation into how to adapt existing B2B operations and information systems to also cater for B2C customers (and the opposite). Data collection was conducted using interviews and observations, and there could be differences in different countries and industries. Future research could use a survey-based methodology to validate the model using the warehouse managers' view on the impact the type of commerce has on warehousing.

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PRACTICAL IMPLICATIONS

The results of this study indicate that even though the differences between B2B and B2C warehousing are significant, there are opportunities for effectively servicing both types of commerce within the same warehouse. The model can be used to understand the challenges that will be faced by companies willing to offer both types of services.

INTRODUCTION

The tremendous growth of e-commerce is challenging logistics operations both at the warehousing and the transportation stage (Yu, Wang, Zhong, & Huang, 2016). Increasingly, more and more end-customers prefer to place orders for goods of any kind online and have them delivered based on their special needs and requests (Kang, Moon, Kim, & Choe, 2016). At the same time, online shopping events like the "Cyber Monday" in the US and the "Singles Day" in China lead to a significant amount of orders placed in a matter of hours and fulfilled in a few days.

Besides the increase in the number of orders placed via on-line channels, due to the emergence of omni-channel retailing, orders placed via more traditional channels (e.g. physical stores) are often fulfilled in distribution centres and delivered directly to a customer's home or collection point (Hübner, Kuhn, & Wollenburg, 2016). As retailers aim to offer a seamless shopping experience to their customers, they also require the logistics services associated with that experience to be able to satisfy multiple different customer requirements (Wang, Mao, O'Kane, & Wang, 2016).

The impact of these trends on business-to-consumer warehousing is significant as the changing role of the end-customer creates new challenges for inventory management and order fulfillment (Manzini, Bozer, & Heragu, 2015). With customers placing orders at any hour with very short lead times while being flexible to change or cancel their orders after their placement, warehouses face an increasing number of disturbances (Giannikas, Lu, Robertson, & McFarlane, 2017). Moreover, logistics companies with warehouses designed for business-to-business commerce are increasingly required to offer consumer-order fulfillment services in order to extend their business offering to their clients and avoid falling behind the competition.

As a result, traditional warehouses processing orders delivered to business clients need to deal with the challenges imposed by B2C commerce. In this paper, we investigate this issue by exploring the similarities and differences of B2B and B2C warehousing. We begin with a brief review of the relevant literature and we then develop a theoretical model to be used in our comparison. The methodology used in this study is described in the section that follows. We report key findings and results before concluding this paper in the last section.

THEORETICAL BACKGROUND

Warehousing has attracted a lot of attention by the academic community, especially in the last two decades. As the importance of warehouses increases in modern supply chains, the effective design, management and control of their operations has been an on-going research question (Faber, Koster, & Smidts, 2013).

Warehousing research can typically be grouped in two categories (Davarzani & Norrman, 2015; Gu, Goetschalckx, & McGinnis, 2007; Richards, 2014). The first category focuses on the planning and management of the four main warehouse operations/entities; that is, receiving, storing, picking and shipping. Using mainly mathematical modelling, simulation and case study research methods, research in this category examines ways to more effectively manage the processes associated with these four operations and to improve decision making. The picking operation is perhaps the most widely studied one, with studies focusing on batching, routing, sorting

The second category includes research associated with the supportive entities of warehousing; that is, all the necessary procedures and decisions that need to be made in

order to enable a warehouse to properly operate. There are multiple different views on what constitutes a supportive entity but the list typically includes, infrastructure/warehouse design, operations strategy, technology and equipment, performance evaluation, human resources (Gu, Goetschalckx, & McGinnis, 2010).

A review of the systems, tools and algorithms developed for warehouse management, indicates that they do not often care for differences between different types of commerce and their associated challenges. The majority of them focus on specific cases given a particular warehouse type, demand, product characteristics etc. without investigating how they should adapt to satisfy orders placed by business clients and/or end-customers. As a result, it is often hard to distinguish between tools and algorithms that are more suitable for warehousing offering B2B or B2C services. Perhaps more importantly it is hard to understand how a particular tool needs to adapt in order to still be applicable in cases where a company wishes to extend its offering to other types of commerce.

THEORETICAL DEVELOPMENT

In order to examine the similarities and differences between B2B and B2C warehousing, we develop a theoretical model based on existing literature. The model consists of two main parts. The first part, demonstrates the key aspects differentiating B2B and B2C commerce from the perspective of warehousing. The second part is adapted from relevant frameworks found in warehousing literature (Gu, Goetschalckx, & McGinnis, 2007; Davarzani & Norrman, 2015) and describes the four main warehouse operations and the supportive entities.

This model will later be used to examine in more detail the similarities and differences between B2B and B2C commerce as well their impact on warehousing. In this study, we focus mainly on the warehouse operations and we comment briefly on the potential impact on the supportive entities.

Aspects differentiating B2B vs B2C commerce

We identify four aspects that differentiate B2B and B2C logistics/commerce:

1. *Products*: Even though a big number of products can be ordered by end-customers today, there are certain items that are mostly used from businesses only. An extreme example could be an aircraft wheel and its associated mechanism.
2. *Orders*: Orders placed by end-customers are expected to be smaller both in terms of quantity and value. This is due to the fact that individual customers tend to satisfy their personal demand or the demand of their household although businesses often satisfy the demand of their own customers, whether these are corporate or consumers.
3. *Client*: We use the term client to refer to the organisation who is buying logistics services from the warehousing company and who is the reason for the placement of orders to a warehouse. In B2B, clients vary significantly as these can be manufacturers, distributors and wholesalers, retailers, corporations of any type or even other logistics providers. In B2C, clients are often retailers (of different sizes) who allow end-customers to place their orders via an online channel.
4. *Receiver*: In B2B commerce, the receiver is typically a company and orders are delivered to its premises. This may vary from large distribution centres to small retail stores. In B2C, the receiver of an order is an individual end-customer requesting delivery at a home or work address or a different collection point.

Warehouse operations

As discussed in the previous section, there are four main warehouse operations. Here, we provide a short description of each one of them. The interested reader is referred to the relevant reviews noticed in the previous section for a more detailed analysis.

1. *Receiving*: This is interface of a warehouse for incoming goods and material flow. Products are delivered to the warehouse, unloaded at receiving areas and checked for accuracy and completeness.

2. Storing: Once products have been received by a warehouse, they need to be organised within the warehouse in order to utilise available space and support the future picking of items.
3. Picking: Picking often initiates with the receipt of customer orders. The term is used to describe all those activities required to collect the items required for the fulfilment of an order.
4. Shipping: Similarly to receiving, shipping is the interface of the warehouse with the outside world but it is responsible for outgoing shipments. Picked items are transferred to shipping docks and loaded to trucks for transportation.

Warehouse supportive entities

In the previous section we saw how other decisions need to be made in order to operate a warehouse. This part of the model aims to capture these decisions and processes. We use the term "supportive entities" to refer to these using the terminology of (Davarzani & Norrman, 2015).

METHODOLOGY

A two-stage methodology was used in this study. We describe each stage in more detail next.

Stage 1

At the first stage a theoretical model was developed based on existing literature. The aim of the model was to guide our data collection and analysis for the factors differentiating B2B and B2C warehousing. This model was described in detail in the previous section. We focus mainly on the warehousing operations rather than supportive entities, but we also comment on a small sub-set of supportive entities.

Stage 2

At the second stage data was collected using two different methods: interviews and direct observations.

Interviews were conducted with warehousing practitioners from six companies. The companies were selected due to the fact that they are offering both B2B and B2C warehousing services to their customers. A semi-structured questionnaire was used to guide these interviews with questions covering both the differences between B2B and B2C commerce and the impact they have on warehousing operations and other relevant activities.

A case company in China was selected for carrying out direct observations. The research team visited six warehouse bases in three different provinces of China offering B2B and/or B2C services. Warehouses offering B2C services were associated orders coming through e-commerce channels. During the visits, the team had the opportunity to observe the different ways warehouses were operated as well as have discussions with warehouse managers and staff members on the management of warehouse operations and relevant activities.

FINDINGS

We report findings from analysing collectively the data gathered from interviews and direct observations. We begin with an examination of the comparison between B2B and B2C commerce from a warehousing perspective. We examine each of the four aspects of our theoretical model separately:

1. *Products*: The range of products available to end-customers increases day after day and consumers can directly order a large variety of goods they need for various aspects of their life (from repairing a car to cooking a meal). Nevertheless, certain products are only sold in a B2B context and it is likely that this will not change, at least in the near future. Warehousing companies that offer both B2B and B2C services are, however, likely to handle a similar product range

in both types of commerce. This is likely due to the way their business model has evolved; increasingly they are asked by their clients to offer both types of services for a certain product type. In cases like this, the products remain the same, however, the unit of measurement might differ. B2B often requires handling cases of items although B2C handles items at the individual level, e.g. a case of USB flash drives versus a single drive.

2. *Orders*: There is a big difference here, as B2C orders tend to be significantly smaller. Most e-commerce orders contain only 1–2 items, with perhaps the only well-known exception being grocery items. On the contrary, B2B orders are large in size and can often fill an entire truck. They also often consist of a small range of SKUs but in big quantities. Another difference has to do with demand partners. Although both types of commerce face peak periods driven by the same demand signal (end-customer orders), business orders can often increase by 3–10 times while consumer orders can increase by 100–300 times (one can take for example the Singles Day event in China). Moreover, the peak periods differ over the year, even if they are due to the same event. For example, the Christmas period creates very high levels of B2C demand in December but this is translated to high B2B demand in October/November. Finally, most B2C orders are often placed at lunchtime, in the evenings and weekends while B2B orders are placed during working hours.
3. *Client*: The client of a B2B service can vary a lot compared to the client of a B2C service. B2C clients are often retailers interested in selling over an on-line platform or wishing to extend their omni-channel offering. On the other hand, B2B clients can vary a lot. An interesting observation is that more and more manufacturers or brand owners wish to sell directly to end-customers thus moving from purely B2B sales to a hybrid model often fulfilled by the same warehousing company. B2C clients also tend to request for more services such as receipt attachment, gift wrapping etc. Finally, from a business perspective, B2B clients often book larger areas of a warehouse for long-term use in order to ensure the maximum required space availability although B2C clients book smaller spaces based on the volume they expect to sell per period. This latter issue leads warehousing providers to serve multiple B2C clients from a single warehouse at the same time.
4. *Receiver*: A typical warehouse services a much larger number of receivers, geographically dispersed in B2C compared to B2B. Moreover, the requirements of each type of receiver differ; end-customers value short lead times, order tracking information, late cancellations and amendments as well as other factors affecting the order-delivery experience. There is normally no interaction between a warehousing provider and the end-customer. In B2B, given an on-going collaboration, the receivers are relatively stable (e.g. a warehousing company will be responsible for delivering to certain retailers over a period of time). This allows a warehousing company to have a regular interaction with the receiver, collaborate with him for a longer period of time and manage disruptions more easily.

We will now examine the impact of the aforementioned differences on each of the four main warehouse operations:

1. *Receiving*: Incoming inventory arrives in bulk in both types of warehousing. However, the complexity in B2C incoming deliveries might be higher, thus requiring more time and resource. This is due to a number of reasons. Firstly, the large number of clients per warehouse in B2C often leads to more deliveries as each one of them replenishes inventory separately and in smaller quantities. Secondly, B2C pallets are more often mixed pallets carrying more than one SKUs, thus requiring more time to unload and check. Thirdly, as some B2C clients can be small retailers, they might not care for loading a delivery truck with their goods in a tidy way that will allow easy and fast unloading.

2. *Storing*: In B2B, a warehouse provider receives, and therefore needs to store, large quantities of the same SKU. Especially in cases when pallets contain a single SKU, this allows for easier storing as pallets can be moved from a truck directly to a storage location without extra handling. It is therefore common for storage locations to store pallets carrying a single SKU. On the contrary, storage locations in B2C are often used to store more than one SKU, either as individual items or in boxes and containers. Especially when small items are stored in a B2C warehouse, the number of SKU's per storage location can be particularly high. It is also critical that items are stored in a way that human pickers can later pick them easily and without the need of extra equipment such as ladders and forklifts. Moreover, B2C warehouses often require a storage location assignment process that meets demand patterns (e.g. differentiate between slow and fast-moving areas) in order to minimise travel time during picking. In B2B, on the other hand, storing aims to mainly improve space utilisation and avoid less-than-full storage locations. Finally, due to the small quantities stored from each retailer in a B2C warehouse, turnover is much higher than in B2B warehouses thus making storing to happen more frequently.
3. *Picking*: The main difference here is the unit of picking due to the difference in orders placed; whole pallets are normally picked in B2B while individual items are picked in B2C. This requires different material handling equipment in each case. Also, as B2B orders are normally large in size, orders are picked in sequence, having multiple staff members picking the required items at the same time. As B2C orders are much smaller, multiple orders (perhaps placed for items of different retailers) are grouped and picked together in a single pick tour. A key challenge here is when a provider has to manage orders of different priorities from the same warehouse (e.g. Amazon Prime orders vs regular orders). Similarly to storing, picking in B2B aims to primarily optimise space utilisation while B2C focuses more on reducing order preparation times. This is the reason why batching and route optimisation are much more important in B2C. Finally, B2C picking is likely to require time for sorting and order consolidation, especially when the contents of an order are picked by different pickers (and in certain cases different buildings).
4. *Shipping*: There are many differences that impact shipping operations. Firstly, the transportation provider differs. In B2B, carriers and truck companies offer transportation services, which is often organised at an order-basis, depending on the characteristics of the specific order. In B2C courier, express and parcel companies (CEP) often last-mile logistics services to end-customers. These often visit the warehouse a few times a day to pick up parcels. This impacts the time available for picking as well as when an order should be picked by. Secondly, It is common for each warehouse to collaborate with more than one CEP companies as clients and end-customers can have different requirements. If this choice is given to the customer during order placement, sorting for shipping can also be time consuming. Thirdly, the loading process needs to be managed differently as pallets are shipped in B2B while parcels of multiple sizes are shipped in B2C. Finally,

An interesting factor that we observed while studying of the above operations is the increasing importance of value-added services in warehouses (Richards, 2014). These refer to activities that can be performed within a warehouse and offer extra services to a provider's clients. Our discussions and observations revealed that these services have become an important part of warehousing and need to be properly managed along with the four more "traditional" operations discussed earlier. In certain cases, they change the meaning of traditional operations. For example, B2C picking almost always requires product packing, receipt attachment and labelling. The impact of these value-added services can be so important that can affect the role of a warehouse itself as it can be

seen as a part of the supply chain with cheaper labour (compared to stores) that can be used to further process a product.

Examples of value-added services observed in this study include the following. In B2B, pre-retailing services to make handling at next stage in supply chain (e.g. stores) easier, labelling, RFID attachment, change of manuals, power cords and software language (for electronics). In B2C, gift-wrapping, leaflets/coupons attachment, returns management, special packaging, ironing and washing.

With regard to the supportive entities, we make the following short comments on three areas:

- *Equipment and IT*: Due to the differences in handling units, different equipment needs to be used for picking items in B2B and B2C. In the former case, forklifts or similar equipment are being used to pick and carry pallets although in the latter, trolleys or parts-to-picker systems are more suitable. Warehouse management systems are necessary in both cases but need to be more flexible and adaptable to meet changes in demand and client requirements in B2C.
- *Human resources management*: safety is a critical issue regardless of the type of commerce. This is why having both people and vehicles working together in the same workspace can be hard. Moreover, due to the need to handle special equipment in B2B, finding skilled employers staff can be more challenging (e.g. forklift drivers or staff that can carry heavy items).
- *Performance measurement*: The basic principles for managing performance apply regardless of commerce type. These are mainly storage density/space utilisation and minimum travel distance. However, B2B warehouses tend to focus more on the former along with high levels of accuracy and successful on-going collaboration with receivers. On the other hand, B2C warehouses prioritise the outbound processes, speed and minimising handling costs

CONCLUSIONS AND DISCUSSION

In this paper, we proposed a theoretical model for identifying similarities and differences between B2B and B2C commerce and understanding their impact on warehousing. The model was used in interviews and direct observations to identify and analyse some of the key factors of B2C affecting traditional warehousing. The results of this study can be used by warehouse providers wishing to extend their business offering to satisfy different types of clients. The model itself can be used for further examining specific cases in more detail.

We conclude this paper with three points of discussion that can lead to future areas of research.

Firstly, due to the popularity of special promotion/shopping days, B2C warehousing can use practices from B2B warehousing to satisfy the challenges emerging from very high demand. As an example, the picking operation can be altered to allow a whole pallet to be picked when a promotion item is ordered by several different customers on a single day. Moreover, items that will be on sale can be pre-processed to save valuable time, e.g. items can be packaged before an actual order is received and stored until they can be labelled accordingly.

Secondly, as business clients and receivers are trying to better manage holding inventory, smaller orders with higher variety and shorter lead times might soon become a norm in B2B. As a result, B2C practices might be useful to handle orders with different characteristics than traditional B2B orders. One could imagine separate pick lists to be created by the warehouse management system when items can be grouped together and be picked in a single pick tour due to orders with small quantities and large variations.

Lastly, and perhaps more importantly, there is a big opportunity for merging and co-managing B2B and B2C operations and inventory. As many warehousing providers serve both types of commerce from their premises –often assigning different areas of a warehouse to different types of clients– the benefits from merging them can be significant. For example, common inventory can better be managed as it can be shared and used according to actual demand. Secondly, staff can be quickly re-allocated during the day at places where manpower is needed most as workload differs between B2B and B2C during the day. Finally, available space in a warehouse can be better utilised according to the actual items needed to be stored rather than according to pre-allocated zones and buildings.

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REFERENCES

- Davarzani, H., & Norrman, A. (2015). Toward a relevant agenda for warehousing research: literature review and practitioners' input. *Logistics Research* , 8 (1).
- Faber, N., Koster, M. d., & Smidts, A. (2013). Organizing warehouse management. *International Journal of Operations & Production Management* , 33 (9), 1230-1256.
- Giannikas, V., Lu, W., Robertson, B., & McFarlane, D. (2017). An interventionist strategy for warehouse order picking: Evidence from two case studies. *International Journal of Production Economics* , 189, 63-76.
- Gu, J., Goetschalckx, M., & McGinnis, L. F. (2010). Research on warehouse design and performance evaluation: A comprehensive review. *European Journal of Operational Research* , 203 (3), 539-549.
- Gu, J., Goetschalckx, M., & McGinnis, L. F. (2007). Research on warehouse operation: A comprehensive review. *European Journal of Operational Research* , 1, 1-21.
- Hübner, A., Kuhn, H., & Wollenburg, J. (2016). Last mile fulfilment and distribution in omni-channel grocery retailing: A strategic planning framework. *International Journal of Retail & Distribution Management* , 4 (3), 228-247.
- Kang, C., Moon, J., Kim, T., & Choe, Y. (2016). Why consumers got to online grocery: comparing vegetables with grains. *49th Hawaii International Conference on System Sciences*, (pp. 3604-3613). Hawaii.
- Manzini, R., Bozer, Y., & Heragu, S. (2015). Decision models for the design, optimization and management of warehousing and material handling systems. *International Journal of Production Economics* , 170, Part C, 711-716.
- McFarlane, D., Giannikas, V., & Lu, W. (2016). Intelligent logistics: Involving the customer. *Computers in Industry* , 81, 105-115.
- Richards, G. (2014). *Warehouse Management: A Complete Guide to Improving Efficiency and Minimizing Costs in the Modern Warehouse* (2nd Edition ed.). Kogan Page.

Wang, C., Mao, Z., O'Kane, J., & Wang, J. (2016). An exploration on e-retailers' home delivery – strategic elements and their prioritisation. *Business Process Management Journal* , 22 (3), 614-633.

Yu, Y., Wang, X., Zhong, R. Y., & Huang, G. Q. (2016). E-commerce Logistics in Supply Chain Management: Practice Perspective. *Procedia CIRP* , 52, 179-185.