Distribution Strategies for Online Retailers

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Abstract—The Internet provides retailers with potentially powerful opportunities to boost sales, increase market share, and generate new business through new services. One of the challenging questions that retailers are facing in that respect is how to organize the logistic fulfillment processes during and after the transaction has taken place. Based on a survey of 55 online retailers (both traditional and Internet-only) this paper investigates the distribution strategies of these different retailer types. This includes the use of infrastructure not particularly designed for delivery to Internet customers like stores and store warehouses, the logistics outsourcing strategy and the company’s choice of delivery area. The independent variables studied are the delivery lead times offered to customers, the assortment choice, the number of Internet customer orders and the company type (traditional retailer or not). It is argued and demonstrated that the distribution channel for Internet customers should be different with existing operations, but for larger Internet order volumes, traditional retailers should switch to direct-delivery distribution centers. The outsourcing and delivery area decision appear to be mainly determined by the complexity of the assortment.

Index Terms—Distribution, e-commerce, empirical research, retail, strategy.

I. INTERNET AS A NEW SALES CHANNEL

The Internet is becoming increasingly important as a new sales channel. Currently, the Internet is only responsible for a minor segment of the $2.2 trillion retail market. This segment is, however, projected to grow 50 times faster than in-store shopping [26]. In May 2000, The Gartner Group stated that consumer purchases via the Internet were worth $20 billion in 1999 and predicted a rise to $147 billion retail in 2003 [7]. The predictions of the different marketing research organizations are, however, far apart. One year earlier, Forrester Research, for example, estimated business-to-consumer (BtC) Internet sales much lower and predicted a worldwide turnover of $3.2 billion via the Internet in 2003 [24]. What they have in common is the prediction of the fast growth of BtC e-commerce transactions. According to a Taylor Nelson Sofres study of 32,000 people in 27 industrialized countries, about 27% of the people are online. Ten percent of the net surfers shop online in a month [40].

Four types of companies that sell online to consumers can be distinguished.

1) Product manufacturers, such as Dell (computers), Unilever (cosmetics, products with high added value), Numico (food additives), BOL (books, media). Direct sales to customers, without using stock-keeping intermediaries, are still not very common for manufacturers.
2) Traditional retailers and wholesalers, such as Barnes & Noble, Albert Heijn, Tesco, Makro, Karstadt, Quelle.
3) New Internet companies without physical assets (intermediary companies), such as Boxatwork and E-bay. Until 1999, the number of companies of this type has been booming. In 2000–2001 there has been a rapid decline (Boo, Etoys, Let’sbuyit).
4) New Internet companies, with physical assets (for example, stock, warehouses, or trucks), such as Amazon, Peapod, Maxfoodmarkets. In addition, this sector has shown a rapid decline, Webvan and Hotorange are examples of companies that went bankrupt.

One of the major problems for companies selling physical products via the Internet to customers is to deliver the goods and thereby meeting the customers’ expectations. In research carried out by European consumers’ organizations, it was found that logistics aspects, such as delivery lead times (or delivery at all), were not met by a substantial part of the investigated Internet companies [10]. Buying through the Internet requires a substantial amount of trust from customers [14]. The potentials for Internet selling may be high, but the promises made on the website have to be realized by the fulfillment processes. If the delivery service hampers, products do not have the expected price-quality ratio, the post-transaction service [38] is not of the expected quality and convenience, then customers do not order a second time (see [30]). As customer wishes may be beyond what is possible or desirable for the supplying company, the need for a good business model becomes evident. Many Internet companies have already gone bankrupt [11], [32]. However, in another Forrester report (see [13]), the number of parcels shipped daily by e-tailers was estimated at 650,000. By 2003, this number could grow to 4.2 million daily shipments. The fulfillment problems are therefore, not expected to become a less important problem.

The main difference with respect to distribution between traditional, nononline retailers (that sell from stores) and online retailers can be found in the delivery policy. Traditional retailers with stores usually do not deliver at home. Internet retailers do deliver at home. This means that thought must be given to how this delivery structure should be set up: which area must be served, which delivery conditions (attended delivery, unattended delivery, delivery to a pick-up point), time windows of delivery, and delivery lead times. This makes it interesting to study which distribution strategies online retailers have chosen to realize the fulfillment.

In this paper, we investigate the distribution strategy that online retailers use to store products, pick the orders, and deliver them at the customer’s home. Distribution strategies can...
be measured by a number of factors, primarily the choice of
distribution channels [2], [38], [41], the delivery area [41], and
outsourcing decisions [38], and is influenced by factors such as
delivery time [38], product characteristics, and number of
orders [6], [41]. In particular, we focus here on the distribution
channel (use of a warehouse delivering directly to Internet
customers, rather than via a store), the company’s outsourcing
strategy for transport and the size of the delivery area as
dependent on the service level offered, the internal operational
complexity, and the existence of a traditional distribution
channel. Section II discusses literature on Internet retailing and
home delivery and different options for distribution channels,
and introduces the research model. This is further explained in
Section III, including hypotheses. Then, the methodology is
discussed and finally, results are presented and conclusions are
drawn.

II. DISTRIBUTION STRATEGY FOR E-COMMERCE

Mallen [23] addresses the problem of selecting distribution
channels for companies. For a retailer, the basic questions are
concerned with the number of levels that are needed in the
distribution channel and how many facilities (warehouses or
stores) per level are needed. A given product can also have
several channels. Mallen gives guidelines for companies to
assist in this choice, based on the objective they have. Some
major determinants for this choice are the market (number of
orders), product characteristics (such as product variety and
product properties), speed of delivery, and others (including
environmental aspects, availability of resources, and business
conditions). Schoenbachler and Gordon [42] argue that the
channel decision should depend on the customers’ preferences.
The choice of the right distribution channel is important for
e-commerce companies [18], [32]. The Internet seems to offer
the possibility to sell products in a large worldwide region
that is beyond what was traditionally possible. However, it
may be difficult to set up an effective and efficient distribution
channel on such a scale [18] and also the developments may go
so rapid, that the channel may have to rapidly accommodate to
the changed number of transactions. However, not much
research has been carried out on distribution strategies of
online retailers. Research is mostly of an exploratory nature
(see, e.g., [36] and [39]) or it gives an overview of different
solutions for fulfillment [4], [27], [30], [35], [43]. Kopczak
[18] addresses the importance of the right distribution channel
choice for home delivery. Particularly, the choice between
outsourcing of the warehouse and transport operations are
discussed. Quantitative empirical or modeling research is still
scarce. Ranchhod and Gurau [31] have carried out research that
is somewhat related to the study in this paper. They focus on
direct (online) and indirect marketing channels as dependent
on characteristics of the company (size), the clients (business
or consumers), and traded products (digital or nondigital, unit
value and unit volume). They show that the implementation of
a particular Internet-enabled distribution strategy (online or via
intermediaries) depends on these characteristics.

Kämäräinen et al. [15] and Punakivi and Saranen [44] inves-
tigate the impact of variables similar to the dependent and inde-
pendent variables in this paper on the delivery costs per order,
and the total mileage needed to deliver a predefined set of or-
ders in a given area. The results are obtained via simulation,
using routing software from CAPS Logistics. They investigate
scenarios with different delivery lead times and delivery time
window sizes, as well as attended and unattended goods recep-
tion.

The distribution strategy of the online retailer determines the
way the orders are fulfilled, the number and type of facilities
used in this fulfillment process, the area where customers will
be delivered, and which processes will be kept in-house and
which will be outsourced. Here, we see the distribution strategy
as a latent (i.e., not directly measurable) variable that depends
on, for example, the service and the assortment the company
wants to offer to customers. We introduce a construct “distri-
bution strategy,” which can be split in three different subcon-
structs.

1) Distribution channel [3], [18], [23]. This contains the
type of facility (store or warehouse) from which the ful-
fillment is carried out
2) Delivery area [15], [44]. The delivery area is the area
serviced by the Internet company, from its facilities.
3) Degree of outsourcing [18], [31]. The product storage
and order fulfillment processes as well as the transporta-
tion can be outsourced to third-party logistics service
providers. We could not acquire sufficient information
on fulfillment outsourcing, therefore, in this paper, we
only consider transport outsourcing.

These subconstructs are interrelated. For example, in case de-
delivery is made worldwide, it is very unlikely that the online re-
tailing company carries out all the transportation in-house. On
the other hand, small-sized delivery areas do not automatically
imply in-house transportation: Many large food retailers in Eu-
rope divide a country in regions, with a warehouse supplying
all stores in the region. The transport is often outsourced. In ad-
in, if the delivery area is large, transport will usually not
be organized from a store, as economies of scale in transport
are difficult to achieve especially for smaller stores. The model,
containing the dependent and independent variables used in this
study is shown in Fig. 1 and will be explained in detail in Sec-
tion III. The next part treats the different dependent subcon-
structs sequentially.

A. Distribution Channel

The customer-delivery distribution channel for an online re-
tailer can take the following forms (see also [3] and [18]):

1) distributing from existing stores;
2) distributing from existing distribution centers (DC), also
supplying conventional stores;
3) distributing from DCs that directly supply the Internet
customers;
4) hybrid structures, using the different facility types men-
tioned previously.

These different options are sketched in Fig. 2.

We can make a distinction between companies that started
as an Internet company (Internet-only retailers) and traditional
companies that have Internet sales activities. Internet-only re-
tailers have the option to operate as a nonstock keeping intermediary or to take care of fulfillment. In the first case, they have to cooperate with third parties who organize the fulfillment process. In the latter case, the company usually carries out the fulfillment operation from a stock keeping distribution center.

All the previous distribution structures are feasible for both traditional and Internet-only online retailers. Peapod (before it started to also use warehouses) in the U.S. and Boxatwork in The Netherlands are examples of new-economy food retailers that operate as a nonstock keeping intermediary and supply customers via third-party stores and/or DCs. The stock ownership is an important choice, since it determines to a large part the stock allocation and process control that a company can exert and therewith the service that can be delivered to the customers.

Although traditional online retailers will be inclined to use their existing infrastructure, order fulfillment from existing facilities, like stores or DCs supplying stores, will no longer be the best solution if the number of weekly Internet orders becomes large. Economies of scale can be obtained by establishing specially designed warehouses, directly supplying Internet customers, run by the company itself.

All choices for the order fulfillment have their pros and cons. Order picking from a store for Internet customers, packing the orders and home deliver them, is not a process for which a store has been designed. In general, the layout and product-to-location assignment in a store is such that sojourn times of customers are maximized. Storing fast moving products relatively far away from each other and having aisles with a minimum of possibility to make short cuts, to maximize the exposure of products, can achieve this [12]. In addition, products are not stored in the shelves sorted on unit turnover within a product family, but often on product margin. Products stored at eye-level are the products with high margins. Furthermore, order pickers working on Internet customer orders in a store may disturb ordinary customers. This situation is slightly different for stores with an adjacent warehouse. In such situations, the order picking process can take place in this warehouse, thereby avoiding the previously mentioned problems. However, especially in densely populated areas, one can see that storage space is increasingly sacrificed for sales area. In conclusion, the efficiency of order picking for Internet customers in stores is low, leading to relatively high labor costs per order.

Order picking from the store DC (i.e., the DC that supplies the store) is usually also not a good solution. In this DC, products are often stored in pallet racks, with long travel distances per order. These long travel distances are justified since order sizes are large (for example, three or four roll cages or pallets in one round trip, where each roll cage represents a delivery to one store). However, the orders of Internet customers are usually small. This means that nearly the same distance (time) has to be traveled for a fraction of the volume of a store order. Or, if multiple customer orders are picked in one route, a complex additional sorting process is necessary. In both cases, the customer orders have to be carefully packed after the order picking, a process new in the store DC. Also, the warehouse management information system has not been designed to support this many small customer orders (that usually need different order clustering, picking, consolidation, and packing methods). In conclusion, we can say that order picking in the store DC for Internet customer orders also does not seem to be a good solution for the fulfillment problem.

The best (i.e., most efficient) solution is probably to have a warehouse, specially designed for direct fulfillment of In-
TABLE I
ADVANTAGES AND DISADVANTAGES OF DIFFERENT DISTRIBUTION SOLUTIONS [4])

<table>
<thead>
<tr>
<th></th>
<th>Advantages</th>
<th>Disadvantages</th>
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<tbody>
<tr>
<td>Order picking and</td>
<td>- low investments, easy to set-up for companies with stores</td>
<td>- stores not designed for efficiency</td>
</tr>
<tr>
<td>delivery from local</td>
<td>- fast response times</td>
<td>- additional processes (order packaging)</td>
</tr>
<tr>
<td>stores</td>
<td></td>
<td>- interference with existing customers</td>
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<tr>
<td></td>
<td></td>
<td>- high operational costs</td>
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<tr>
<td></td>
<td></td>
<td>- small service area</td>
</tr>
<tr>
<td>Order picking from</td>
<td>- low investments, easy to set-up for companies with DC</td>
<td>- store DC not efficient for small orders picking</td>
</tr>
<tr>
<td>DC’s supplying stores</td>
<td>- larger area can be served from stores</td>
<td>- interference with store orders</td>
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<tr>
<td></td>
<td></td>
<td>- also sub-carton picks necessary in DC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- longer response times</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- additional, smaller trucks necessary than for supply to stores</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- cannibalization of stores sales</td>
</tr>
<tr>
<td>Order picking from</td>
<td>- layout, design fit for small-orders picking</td>
<td>- high investments</td>
</tr>
<tr>
<td>direct delivery</td>
<td>- economies of scale obtainable</td>
<td>- new distribution channels often have to be set up</td>
</tr>
<tr>
<td>DC’s</td>
<td>- no interference with other processes</td>
<td>- long response times</td>
</tr>
<tr>
<td></td>
<td>- larger area can be served from stores</td>
<td>- homogeneous transport mode</td>
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Although it may seem attractive to draw customers from a wide area, delivering in this area may be rather complicated. Old-economy companies may want to use their existing facilities (stores, warehouses) and forwarding companies. These facilities and companies cannot always easily switch to new delivery regions. New regions may require new delivery codes in the information system, new sorting lanes on the sorter machine, new shipping label types, documentation in other languages, etc. In addition, the forwarding company may not deliver in the particular region. The costs related to the switchover to the new regions may be greater as the total new region becomes larger.

Internet-only companies are maybe not bothered by existing facilities but have similar problems when the delivery region becomes larger. Furthermore, transportation companies with a dense world-wide delivery network, with knowledge of international import duty and tax rates and that can deliver at a low price, are nonexistent according to McCullough [24]. The result is, that the companies that do ship globally to Internet customers, usually only ship to a few countries in Europe, Asia, and the U.S. where they can fill orders from local warehouses [24]. The advantages and disadvantages of local/regional versus (inter)national delivery have been summarized in Table II.

C. Outsourcing Strategy

Both the fulfillment and the transportation process can be outsourced. As argued earlier, not many firms shipping internationally will organize the transportation in-house. However, especially retailers that deliver from existing facilities in a relatively small area around the facility and with own vehicles, will deliver themselves.

According to McCullough [24], the fulfillment outsourcing depends mainly on the number of daily orders processed from the facility. Retailers with less than 100 Internet orders per day or over 10 000 orders per day should tackle fulfillment in-house.
The number of orders is then either so little that they can easily be handled at a cheaper rate than a logistics service provider could do this, or the volume is too large to be handled by third parties. Peapod.com and Amazon.com are examples of companies that originally operated as a virtual company outsourcing fulfillment and transportation, whereas the fulfillment is now carried out in-house to a large extent. If the daily volume is between 100 and 10 000 Internet orders, retailers should outsource the fulfillment to gain economies of scale they cannot get on their own. The outsourcers can share warehouse space and resources across online merchants. Demand should be managed in-house and the fulfillers’ inventory and planning systems should be integrated in the website, to make promises based off true inventory and service availability [24]. In reality, however, other solutions can be noticed, especially when products are complex. Fresh food online retailers, for example, have the tendency to keep all warehouse operations in house.

### III. Research Model

In order to investigate good potential choices for an Internet company’s distribution strategy, we will work out the research model presented in Section II in more detail.

The dependent variable in the research model is the distribution strategy, which is split in three different subconstructs—distribution channel, outsourcing strategy, and delivery area. One indicator only measures the subconstruct “distribution channel,” namely the use of one or more direct delivery warehouse. It has value 0 if no such warehouse is used and 1 if one or more such warehouses are used for picking and distributing orders to Internet customers. The indicator “transport in-house” (0=transport outsourced, 1=transport in-house) measures the outsourcing strategy. Delivery area is measured by one binary indicator, namely local/regional shipment (delivery area=0), and national/international shipment (delivery area=1).

Although it is unlikely that the model is complete, the important elements are included. It was not possible to obtain information on other factors in distribution that might be important for the success of the online retailer. Examples are returned items, the mode of delivery, the type of transport carrier, the relationship with the carrier and whether delivery is attended or not.

De Koster [3] also indicates some independent variables of which it is conjectured that, for online food retailers, they have an impact on the firm’s distribution channel (the other dependent constructs were not investigated). These independent variables are “operational complexity” and “existence of a traditional distribution channel”. Here, we also define “service level.” These factors determining distribution channels were also suggested by Faber et al. [6], Van Goor et al. [41], and Stock and Lambert [38]. We will discuss them one by one.

#### A. Internal Operational Complexity

The complexity of the operations of an Internet company determines to a large extent how the products can be order picked, distributed, and handled, thereby impacting the construct distribution strategy. For internal operational complexity, we can think of indicators measuring the type and width of the assortment (see the following), the number of daily orders that have to be handled, the number of employees, the technology and systems used, etc. In [6], the construct “operational warehouse complexity” is defined and measured by only two indicators, being the number of stored product codes and the number of daily order lines that have to be picked. On the basis of 19 recently realized warehouse operations, there appears to be a clear relation between the complexity of the warehouse, as measured by these two indicators and the planning and control systems used (especially whether tailor-made or standard software can be used for the operational control). Since retailers essentially store and distribute products (or have them stored and distributed by third parties), we expect that the same indicators can therefore measure the internal operational complexity.

Consequently, we propose similar indicators for the construct “internal operational complexity.” The following are the indicators.

1) **Assortment type.** The assortment type can be simple (containing products that are nonperishable, nonfragile, no conditioning or special handling necessary in storage and transport) or complex, with respective values 0 and 1. An assortment is complex, if it does not meet the criteria. Usually, when products are perishable, for example fresh products like strawberries or flowers, they automatically need conditioning in storage and transport. Special packaging, handling, and hygiene regulations may apply in case of food. Products may also be complex in storage, handling, delivery and installation without needing conditioning. Think of carpet that has to be laid at the customer’s home, or a heavy washing machine that has to be installed at the customer’s home. A simple assortment lacks vulnerable, fresh, difficult-to-handle products and products needing installation.

The assortment type has an immediate impact on the delivery area and the outsourcing strategy. Simple assortments can be delivered without any difficulties to any part
of the world, at least in principle. Products in complex assortments cannot so easily be handled and shipped over long distances, certainly not at low rates. Fresh products have to be chilled in transport and storage, which also limits transport distances. Outsourcing the storage and delivery of such complex products is also not easy, since special equipment (conditioned trucks and warehouses) and special skills and certificates are required.

We can now formulate the first research hypotheses related to internal operational complexity and its impact on the company’s distribution strategy

\( H1(a) \). Online retail organizations with a complex assortment type keep the transport in house, \( H1(b) \). Online retail organizations with a complex assortment type deliver mainly on a local or regional scale.

2) Assortment width. The assortment width can be shallow or deep. The more products there are in the assortment, the more difficult the management process becomes, thereby impacting for example the outsourcing strategy. All products have to be maintained in the warehouse information system, they have to be visible on the website and online availability may have to be displayed. If multiple facilities deliver the products, then one must be sure that sufficient stock of every product is available in any of these facilities. This suggests that a wide assortment can be supplied better from a warehouse than from multiple stores. The indicator has value 0 in case of less than 5000 products and value 1, otherwise. Five-thousand products are about the number of products that can be found in a small-sized supermarket. Most companies offer an assortment somewhat less than this.

The associated hypothesis is:

\( H1(c) \). Online retail organizations with a wide assortment use a direct delivery DC to fulfill the orders.

3) Number of Orders per week. According to McCullough [24], this number of orders determines whether the company should outsource the warehouse and transport operations or not. A large number of orders should be outsourced. The number of weekly orders will also impact the distribution channel, since a large number of small Internet orders cannot easily be handled by existing facilities that are designed for different purposes. The indicator has value 0 or 1, where value 0 means less than 1000 orders per week, 1 means more than 1000 orders per week. One-thousand Internet orders per week means a rather small-sized Internet operation. However, in the sample described in the sequel this number appears to be more than most companies have. Less than half the online retailers in the sample have larger numbers of Internet orders [for example, CDNow, Tesco, Albert Heijn, Amazon, and Webvan (now bankrupt), and Sears].

Although the number of orders that could be considered as “large” might be dependent on the assortment type, such a relation was not found within the sample considered (a chi-square test for independence resulted in \( \chi^2 = 0.24, p = 0.77 \)).

The associated hypothesis is:

\( H1(d) \). Online retail organizations with a large number of online orders outsource transportation

B. Service Levels

According to Lalonde and Zinszer [19], customer service consists of many tangible and intangible elements. An important element is the delivery lead-time [41], which will directly impact the distribution strategy. The shorter the delivery lead-time offered, the more service is offered to customers. Often, the customer can select delivery lead times himself, where shorter delivery lead times are more expensive. The delivery lead-time can be short (in case a service is offered of 48 h maximum), or long. Many mature online retailers offer a delivery time of 48 h as one of the (often rather expensive) possibilities. The delivery lead-time has impact on the delivery area. The longer the lead-times, the larger the area that can be served at low costs. Short delivery lead times can only be realized in case either the delivery area is small (this is, of course, not a sufficient condition), or if the additional costs of rapid shipments can be charged to the customer. The latter can only be done in case of special, rather expensive products. Delivery time = 1 means that one of the selection possibilities for delivery is within 48 h; 0 = longer than 48 h.

We hypothesize that customers at larger distance are reluctant to pay for rapid delivery. This leads to the following hypothesis:

\( H2 \). Online retailers with short delivery lead times deliver mainly locally.

C. Internet-Only Company

As remarked in Section II, we make a distinction between companies that started as an Internet company and traditional companies that have Internet sales activities. Before they started online selling, traditional retailers already had existing facilities like stores or stock-keeping warehouses and control over this distribution infrastructure. The indicator is abbreviated as “only web-based” and has value 0 if the company has other major (in terms of revenues) sales channels next to Internet and 1 otherwise. As traditional retailers will be inclined to use their existing infrastructure (stores or store warehouses) for Internet fulfillment, the value of this indicator will immediately impact the chosen distribution channel.

The following hypotheses can now be formulated:

\( H3(a) \). Traditional online retailers mainly use existing infrastructure, like stores and store warehouses, for shipping to customers.

\( H3(b) \). Internet only companies mainly use warehouses that directly ship to the customers.

The following hypothesis, in line with the earlier discussion, combines the consequences of operational complexity and the existence of a traditional distribution channel.

\( H4 \). Traditional online retailers with a large number of weekly orders operate from warehouses that directly ship to the customers.

As remarked in Section II, some correlations between the dependent constructs can be expected. Transportation will almost certainly be outsourced for global operating companies. It is, however, not obvious that regional delivery should be carried out in-house. For example, many regional food retailers in Europe outsource transport from warehouses to the stores. Therefore, correlations are not obvious and do not imply causal relations between the dependent variables. In addition, since changes in
e-business evolve very rapidly and adaptation of the dependent
variables is very costly for a company, choices made observed in
practice are not necessarily optimal for an individual company.

In the next sections, the methodology and research results are
described.

IV. METHODOLOGY

After an extended Internet research, carried out during
1999–2001, 55 companies that offer products via the Internet
and home-deliver the orders have been included in the analysis.
Only companies that were still active early May 2001 have been
included (since then however, some of them have disappeared).
Individual stores that also home deliver goods have been left
out. There appears to be a considerable fluctuation, especially
in the number of Internet-only retailers. The number of com-
panies selling products via the Internet steadily increases,
but simultaneously firms have disappeared. In addition, the
distribution channel is not a constant for most companies.
For example, Peapod used to serve mainly as an intermediate
between supermarket organizations and customers (hence, with
distribution channel indicator 0). However, since the estab-
ishment of its new Chicago, Long Island, and San Francisco
warehouses, it plays an important role as Internet food retailer
(with indicator 1 because of the use of a self-controlled direct
shipment DC). Albert Heijn and Delhaize were constantly
expanding the area where food home shopping is possible,
thereby changing their distribution channel.

It is very difficult (or rather impossible) to demonstrate that
the sample is representative for the entire worldwide population,
since this total population is not known and since the popula-
tion changes rapidly as well. Nevertheless, we have attempted
to achieve this, by including both larger and smaller retailers
and including companies from eight different countries. Also,
the companies come from different sectors, such as mail order,
department stores, food, and book retailers.

The data (i.e., the indicators used to measure the constructs)
of the included companies has been obtained from several dif-
f erent sources. These sources include the following.

1) The company’s website. The websites of all companies
included have been studied. The websites often tell
whether delivery is from a store or from a warehouse and
whether the warehouse is used for store delivery as well.
2) Information also has been obtained from several profes-
sional journals, such as Financial Times, Business Week,
and several professional logistics journals. Specifically,
American companies are often in the news. Other impor-
tant information sources with many facts on Internet re-
tailers are De Koster and Neuteboom [4], Siebel [35], and
Pflaum et al. [27]. Xie and Wang [46] describe eGuo.com
in China.
3) All companies have been sent written questionnaires by
e-mail, but the response was low—only 10%.
4) For five companies, interviews (written or orally) have
been held with an IT or Logistics manager with knowl-
edge of the Internet distribution channel.
5) For another ten companies, information has been obtained
through student projects at the particular company.

In fact, all information—apart from the number of daily or-
ders—was relatively easy to obtain. Many companies are reluc-
tant to share the number of orders, even if used anonymously.
Finally, 55 companies in eight countries, for which information
on all (but one) variable could be obtained, were used; informa-
tion, with respect to the number of weekly customer orders,
could be obtained for only 47 of these companies.

Fig. 3, Fig. 4, and Table III present an overview of the sample.
Referring to the four types of companies mentioned in the intro-
duction (manufacturers, traditional retailers, stock keeping, and
nonstock keeping Internet-only retailers), it can be concluded
from Table III that online manufacturers are not included in the
sample. “Companies without physical assets” are the web-only
retailers, without a direct delivery warehouse (four companies
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TABLE IV
CHI-SQUARE TEST VALUES FOR INDEPENDENCE, WITH EXACT SIGNIFICANCE LEVELS (TWO-SIDED TEST) BETWEEN PARENTHESES AND NUMBER OF OBSERVATIONS BETWEEN BRACKETS. N.S.: NOT SIGNIFICANT AT 10%

<table>
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<th></th>
<th>Distribution channel</th>
<th>In-house transport</th>
<th>Delivery area</th>
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<tbody>
<tr>
<td>Assortment type</td>
<td>7.24 (0.011) [55]</td>
<td>22.7 (0.000) [42]</td>
<td>22.1 (0.000) [46]</td>
</tr>
<tr>
<td>Orders per week</td>
<td>9.02 (0.005) [47]</td>
<td>N.S. [39]</td>
<td>N.S. [44]</td>
</tr>
<tr>
<td>Delivery time</td>
<td>4.60 (0.07) [45]</td>
<td>12.9 (0.000) [40]</td>
<td>16.4 (0.000) [45]</td>
</tr>
<tr>
<td>Only web-based</td>
<td>9.55 (0.002) [55]</td>
<td>7.83 (0.007) [42]</td>
<td>N.S. [46]</td>
</tr>
</tbody>
</table>

V. RESULTS

First, some chi-square tests for association between the dependent and independent variables have been carried out. The results are summarized in Table IV.

Table IV shows that the indicator “assortment width” appears to be not significantly related with any of the dependent subcon structs and has, therefore, been left out in the remainder of the analysis. H1(c) is, therefore, rejected. In order to investigate the significant relations in Table IV further, a cross-table analysis (see, for example, SPSS application guide [37]) was carried out. The results are summarized in Table V.

Table V supports hypotheses 3(a) and 3(b). Traditional retailers, also selling products via the web, mainly use their existing infrastructure (mainly stores; store warehouses are hardly used), rather than setting up separate direct delivery warehouses (30.9% versus 23.6% of all traditional retailers). In addition, web-only retailers make little use of existing third-party store outlets to sell products (7.3% of all retailers). Rather, they set up separate Internet warehouses from which they ship directly (38.2% of all retailers). The online retailer usually runs these warehouses.

Table V also directly supports hypothesis 2. If delivery times are short (Delivery time=1), then companies distribute locally or regionally rather than (inter)nationally (55.6% versus 17.8% of all retailers). In addition, the opposite reasoning seems valid. Companies that ship locally generally have short lead times (55.6% versus 2.2%). Companies in general do not want to ship over long distances with high-speed service (42.2% of all companies deliver over long distances, but only 17.8% have short delivery times and 24.4% have a long delivery time). This is due to the high shipment costs involved in such express services that, very often, may outweigh the value of the product itself. Instead, they choose for longer delivery times.

The assortment type appears to have a strong impact on the outsourcing decision for transportation. Nearly all companies that have a complex assortment type (42.9% of all companies in

included in the sample) keep the transport (for a substantial part) in house, rather than outsourcing this process. This supports hypothesis 1(a). The assertion that the fulfillment (storage, order picking) is kept in-house for companies with complex assortment types, could not be investigated sufficiently in our model, but this appears to hold for nearly all companies for which we had this data (about 20). Further research is necessary here. Table V also shows that online retailers with a complex assortment type deliver mainly on local/regional scale (47.8% versus 6.5%). This supports hypothesis 1(b).

Since hypothesis 4 refers to a subset of the online retailers, it has been tested using a layered cross-table analysis. Results can be found in Table VI. The results shown in this table are significant ($\chi^2 = 4.88$, $p = 0.047$). The table shows that traditional retailers with many orders tend to use direct delivery warehouses and those with few orders tend to use no direct delivery warehouses (primarily existing stores).

We can conclude, on the basis of the small sample investigated in this paper, that most hypotheses are supported by the data. Only hypotheses 1(c) and 1(d) have been rejected: The assortment width does not impact the choice of distribution channel and there is no dependence between the number of online orders and outsourcing. There was insufficient data to
draw any conclusions on outsourcing the fulfillment for online retailers with a complex assortment.

VI. Conclusion

In this paper, we have formulated a research model for the relation between the customer service, the company’s internal organizational complexity and the existence of a traditional distribution channel on one hand and choices for the company’s distribution strategy on the other hand. Three indicators for three different subconstructs (the distribution channel, the outsourcing strategy, and the delivery area) measure the distribution strategy.

In order to investigate the validity of the model sketched in Fig. 1, hypotheses were formulated, which were tested on a small sample of 55 online retailers. For the independent constructs Service level, Internal operational complexity and Existence of a traditional distribution channel, 5 binary indicators were used, four of which appeared to have significant association with the dependent variables. Also the dependent indicators were measured as binary variables.

We can conclude that a positive association between service level, internal operational complexity, existence of a traditional distribution channel and the distribution strategy could be established. This means that companies with complex assortments tend to keep the transport planning in-house, work in handling, sometimes large, numbers of new Internet customers with direct delivery warehouses. Their infrastructure is completely designed to service this purpose. Otherwise, the company customers have to be delivered in the same area where the company is active. In order to investigate this further, the sample should be substantially larger in order to contain both mail order and nonmail order traditional companies and both companies with large and small number of orders.

Several important factors have been left for further future research. Examples are transport strategies, and cannibalization of existing stores, for companies with a dense store network. The latter may have impact on the distribution channel of the company for Internet orders. Companies with a dense store network will be reluctant to deliver products to Internet customers in the store’s area from a central Internet DC, thereby potentially cannibalizing the store’s sales. Especially franchisees will oppose this.

It may be interesting to repeat the research with a larger sample that covers more countries and more types of companies. As the type and number of companies involved in online retailing is still constantly changing and new opportunities still emerge, it can be expected that more insight into distribution success factors of online retailing can be obtained from such research.

References


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