The Impact of E-Commerce on book wholesale operations

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Abstract

Hodges Book Company (HBC) began the last decade of the 20th century as the premier wholesaler in the book industry. Its position had been solidified by significant systems development and the provision of next-day delivery to large portions of the traditional bookstore market. HBC made customer service to the bookstore its focus and had developed supporting programs that helped the individual retail bookstores be more successful in managing its business.

The advent of the Internet had a tremendous impact on the traditional book wholesaler. When HBC management committed to provide contract order fulfillment for an e-commerce book website, they struggled to anticipate the cost impact and operational changes they would encounter. Students are asked to model the operational process changes to the traditional business using static and dynamic methods and assess the broader industry competitive ramifications.

Note: This is a fictitious case developed for educational use. All statements, names, numbers, dates, etc. used herein were created for the purposes of this case and should not be construed as factual. Any resemblance to any actual organization or individual is purely coincidental.

Key Words: Distribution, Operations Management, Logistics, and Supply Chain Management

Objectives

1. To understand basic concepts and processes of distribution and order fulfillment.
2. To explore the impact of the transition from large batch order fulfillment processes to high volume single unit processes.
3. To apply modeling methodologies to help understand the transition from a traditional wholesaling business to a direct-to-consumer fulfillment system, including static spreadsheet analysis and dynamic simulation modeling.
4. To assess the broad impact of disruptive technology such as the Internet on business processes and competitive structure of an entire industry.

INTRODUCTION

The winds of change had become a storm. Tom Hodges (Tom) was the founder and President of Hodges Book Company (HBC). HBC was one of the leading wholesale distributors of books in the United States, providing large shipments to retail bookstores. A small forward-thinking Internet company, RioGrande.com (RG), had begun to revolutionize book retailing and distribution. RG customers could identify any published book currently in print and order it on-line from this Internet-based company. RG promised delivery of the book to the customer's designated ship-to address. RG had initially been buying batches of books from HBC to restock its own warehouses, but had recently approached HBC about directly fulfilling customer orders on RG's behalf.

Tom was concerned about introducing an extremely high volume of single book orders into his system which was designed for large batch orders. Tom wondered what this change would mean to his processes, capacity, level of service and cost. And on a more far-reaching level, what about his competitive position in the industry, not to mention his close relationship with traditional brick-and-mortar stores. The proposal to directly fulfill RG's customer orders could either establish HBC as a leading player in the fulfillment of Internet book sales, or it could destroy the company. Should HBC take the risk? How could operations be modified to efficiently handle a high volume of single book orders? Whatever changes needed to made, they would need to handle other Internet resellers as well as RG. There was much to be done and little time to do it.

Background

Tom established HBC in 1972. Through his leadership, HBC had grown to its current status as the best in the business at providing shipments to retail brick-and-mortar bookstores. HBC was the largest book wholesaler in the U.S. The company had the largest book title base from which customers could choose, as well as the most sophisticated information systems. Tom was widely respected. He was known as a dedicated family man, an employer who hired good people whom he referred to as "Associates" and an individual who treated everyone equally.

Before the advent of book wholesalers like HBC, each retail bookstore ordered directly from each publisher. Every bookstore's ordering process was different, and lead times from the publishers were several weeks. As a wholesaler HBC provided the retail bookstores a valuable service by providing a common, streamlined ordering process – in some cases directly integrated

with the bookstore inventory systems, and lead times of one to two days instead of several weeks. Bookstore purchasing departments now had a single convenient source for their book re-supply needs. HBC's success in the bookstore industry was due in large measure to the information systems and order fulfillment processes the company had developed in-house. Over 20 years HBC's team of in-house professionals had honed these systems to provide the consistent and reliable service on which the traditional retail bookstores had come to rely.

However, little had changed for the end consumers. They were limited in their book searches to the small inventories available at their local bookstores. If retail customers wanted a book that was not in inventory, they would have to place a book order through the book store, wait for it to be special ordered, and then make a trip back to the store to pick up the order when it was finally in stock. Consumers were generally limited to the 25,000 titles that on average a small store might carry.

The emergence of the Internet revolutionized wholesale and retail book distribution. RG established a web site on which it offered "all titles that are in print" and provided direct delivery to consumer's homes. RG's initial approach involved offering the title database carried by HBC and other book wholesalers in the industry. The RG database contained about 500,000 titles that could be purchased online with delivery times varying from next day (i.e., the item was in-stock at the RG facility) to several days (i.e., the item had to be shipped from a wholesalers' warehouse to the RG facility for shipping to the consumer.) RG's new business model was readily embraced by frustrated bibliophiles.

The importance of the shift from the limited inventory in the traditional bookstore to the massive inventory and electronic availability in RG's virtual store was not lost on Tom. Tom knew that HBC was the best company in the world at providing large shipments to bookstores that sold directly to customers from retail store fronts. However, Tom wanted to ensure that HBC met the growing demands of these new Internet companies of which RioGrande was first. He needed to call a meeting with Vice President of Operations Clay Donton and Clay's staff to review HBC's current processes and to explore the impact of RG's proposal that HBC engage in fulfilling Internet initiated orders.

Existing Process Overview

Appendix A - Figure 1 summarizes the existing process at HBC.

1. Receive Book Shipments

Incoming shipments from book printers or publishers were received in pallet, carton, or smaller quantities at the rear of the warehouse. Receipts of inventory were input into the inbound inventory system, assigned a warehouse location, and then processed to that location by a group of stockers who utilized scanners to verify the location placement and quantity placed on the shelves. The inventory at this point was in a "received-but-not-stocked" status.

2. Stock Books Into Inventory

The warehouse was divided into several sections. The company stocked books in locations depending on expected annual demand for the title, the form and quantity of the supply orders received from publishers, and the expected order quantities per bookstore order to be

filled. When stockers placed the books in the assigned locations, the inventory system data was updated with a new in-stock quantity which included the just stocked items and their location. Appendix A - Table 1 summarizes the types of storage locations.

3. Receive Orders From Bookstores

In most instances, traditional bookstores placed orders by phone, or if more technologically advanced, by Electronic Data Interchange (EDI) orders where an order file was transmitted to HBC from an in-store inventory system. Free freight incentives offered by HBC encouraged orders of at least 100 units (HBC called one book a "unit"), thus bookstores traditionally waited until they had a large order to process through the book wholesaler. The average frequency of a given store placing new orders with HBC was about twice per week. Orders that HBC received by 11 a.m. and for which the books were in stock were guaranteed to be shipped by 5:00 p.m. the same day. This level of service was important to HBC's bookstore customers.

4. Release Batches of Orders to Warehouse

At several points of time during each week day (See Appendix A - Table 2.) all accumulated orders received from bookstores were released as a batch of printed orders to warehouse operations to be picked, packed, and shipped. The batch computer jobs not only printed the orders with the inventory locations to assist the warehouse pickers, but also adjusted book inventory availability levels to show that certain books were now allocated to orders. The allocation of inventory to orders and generation and printing of picking lists for each run took up to 60 minutes to complete.

Once orders had been released to the warehouse floor, a paper picking ticket was created in the print room, and transferred to the warehouse for picking. The warehouse system was updated and completed order information was passed to both the inventory system and manifesting system allowing the inventory levels to be updated and shipping information to be prepared for manifesting.

The package manifesting system was integrated with the operations system. This manifesting system recorded the actual weight of the shipping packages, checked the shipping information, recorded the invoice charges for shipping, and generated the package labels for each shipping carton. The information content and format of shipping labels were developed in-house to satisfy the shipping requirements of UPS and other carriers.

The re-supply of books from publishers was managed as an independent demand inventory system. As quantities of books were allocated to be picked from storage, their on-hand inventory quantities were updated, and once the reorder level was reached, a new re-supply order was generated and sent to the book publisher for more books to be printed and shipped to HBC.

5. Pick Ordered Books from Shelves

Picking was the most time-consuming process in the warehouse, and the most prone to error. The warehouse was laid out to minimize the pick path for those people tasked with picking orders. Pick path is the distance an order picker has to travel to find and pull all the books on their order. The warehouse layout and pick path design started with the order picker at

the right front of the warehouse with a rolling cart, had them travel a serpentine route through the right side of the warehouse to the rear of the building, and then return down the left side of the building to the front left (refer to Appendix A - Figure 2). Here the orders were handed off to order checkers who manually counted the number of books picked. Travel time through the warehouse was a major time requirement. HBC found that the larger the order quantity to be picked, the better.

6. Order Count Verification

At the completion of the picking process and prior to packing, the books picked for each order were re-counted to verify picking accuracy. If a book was missing from any order, an associate would try to locate the missing book before "slashing" that item from the order. Slashes were caused by the actual book inventory in a storage location not matching the inventory system data. Slashes were recorded on the paperwork manually and later edited in the computer system to allow correct billing of actual shipping quantities and update the on-hand inventory data.

7. Packing

The large orders were packed from the packing cart onto a flat cardboard base. The books making up a given order often weighed up to 50 lbs. Once the books were stacked on the cardboard base, the packing slip was attached and the shipment was pushed off onto a conveyor-fed machine that shrink-wrapped the stack of books to the base to provide stability during shipping. Shrink wrapping was an automated heating process and did not have an operator assigned to this task. After shrink wrapping, the orders continued on the conveyor to a boxing area. Here an associate noted the height of the shrink wrapped books, selected an appropriate size cardboard carton box, and slipped it over the shrink wrapped set of books. After the box was applied, the carton moved through a taping process manned by an associate where the boxing process was completed. A shipping label was placed on the outside of the box to identify the order inside. Once this process was complete, the order traveled via conveyor to the manifesting area.

8. Manifesting

As each carton approached the manifest station, an associate would slide the carton onto the scale, scan the identification label on the outside of the carton, wait for the printer to print the label, and then apply it to the outside of the carton. The system would record the order number, case number, and actual weight of the package and record it for manifesting purposes

9. Preparation for Shipping

Cartons were divided at the end of the manifest line into levels of service (UPS Ground, two-day, or next day delivery.) Larger cartons were packed directly into delivery trailers using

an expandable conveyor that was pulled into the back of the trailer. As the trailer filled, the expandable conveyor was extended back out of the trailer onto the warehouse floor.

A New Operating Environment

New operations processes to handle the high volumes of single-unit Internet orders from the consumer would be fundamental to servicing the needs of Internet retail sellers such as RG. RG wanted to ship directly from the wholesale distributor's warehouse to the consumer in order to reduce order turnaround time to the consumer and RG inventory. Tom and Clay decided to plan for a scenario in which half of the ultimate consumer purchase of books (RG and other Internet sellers) would eventually arrive to HBC in single-book orders versus larger size orders from bookstores. Based on traditional bookstore order volume per hour, they arrived at the traditional and future volumes of large and small single-unit orders shown in Appendix A - Figure 3. For planning and analysis purposes, they decided to estimate that large bookstore order quantities were 100 units (books) each, while the Internet orders were one book each.

Proposed Process Modification for High Volumes of Single-Unit Internet Orders

Picking Order Aggregation

Clay felt that by combining the small single-book customer orders into large picking orders that he could maintain the same efficient picking process for both small and large orders. An information system change would be required to batch the small orders together into groups of 100, thereby creating an aggregate order for picking purposes, and then a new breakdown process added to take the aggregate picking orders and convert them back into 100 separate single-unit orders that were matched up with their paperwork.

Picking Order Disaggregation (Sorting)

Sort orders would be batch picked together from a summary-picking list that had preprinted packing slips for each individual small order attached. These preprinted packing slips would have a sort slot number that could be associated with a small order to match up both order and paperwork for packing. The sorter would start an order by scanning in the aggregate picking order number. The system would then ask the sorter to start scanning books. As each book was scanned, the system would assign a sort slot for the sorter to place the book. At the completion of the sorting process, the aggregate picking order was broken down into many smaller customer orders as shown in Appendix A - Figure 4. Prior to moving the sort carts to the packing area, the sorter would place the paperwork for individual orders into each sort slot to finalize the process.

Small Order Packing

Clay decided that small orders should be handled at a separate packing area where the individual orders were taken from the rolling sort carts and packed onto a folding T box along with the order's packing slip. Folding T boxes were designed to allow the packer to quickly wrap various sizes of books in cardboard. The packer would place the book on the T box, fold in the outer flaps which covered the ends of the book and then fold the long cardboard base of the T

around the outside of the flaps thus securing the book. The RG brand logo was printed on the outside of the T box. Hot glue was applied to the end of the T box to seal the container. Once the package was finished, a label would be applied to the order identifying it for manifesting purposes, and it was passed down the line to manifesting. Appendix A - Figure 5 depicts the T-box packing process.

Manifesting

Although the process would be the same as for the large orders, volumes would dramatically increase through this area and the number of manifest stations would need to be determined.

Preparation for Shipping

The T boxes would also be sorted into levels of delivery service and dropped (or thrown) into cardboard containers on pallets. Their small size made it difficult to move them individually so they had to be placed into a larger cardboard container box to facilitate quick loading and unloading onto the package carrier trucks.

Performance Metrics

HBC had two primary performance metrics (fill rate and delivery schedules) to gauge the success of a bookstore order. It was critical to understand the proposed process impact on HBC's performance and customer satisfaction. Fill rate was a measure against which the initial order was gauged. If a book store ordered 100 units and HBC could fill all 100 units then they had achieved a 100% order fill rate. This fill rate was calculated after batch processing of orders into the order and inventory systems. Since HBC's information systems operated in a batch-job order processing environment, inevitable inventory inaccuracies sometimes resulted in time lapses between actual inventory stocking or picking, and batch database updates. Other causes were due to books being damaged or misplaced or incorrect quantity data inputs during stocking or picking.

These missing books led to another internal metric called "Slashes." Slashes were items that HBC's systems had predicted to be in inventory, but the pickers and order checkers could not locate. These items were "slashed" (so named by the ink mark on the paper) from the order and order quantities adjusted to reflect the missing item. Invoices to bookstores were adjusted to reflect the missing books. HBC's traditional fill rate had been 95% (i.e., a slash rate of 5%).

Clay expected the same fill rate and slash rate for the Internet orders. The impact, however, would be more dramatic from the Internet customer's point of view. Traditional book store customers viewed shortages differently when they received 95 of their original 100 books in the order. Under these circumstances only one customer (the book store) is slightly perturbed. When dealing with one unit orders to consumers, however, this historical fill rate performance meant that five customers would not receive their orders. These customers would be completely denied their product, and would likely be more than a little irritated. Thus the impact of the proposed Internet customer direct fulfillment business on customer service expectations would be dramatic.

Another important measure for HBC was on-time shipping. As noted earlier, orders that had been received at HBC prior to 11 a.m. (and released to the warehouse in the 12:30 batch release cycle) were guaranteed same day shipping and were checked against manifesting data each evening to see if shipping service level targets were met. These service levels were the fulfillment of HBC promise to ship "that order - that day." (See Appendix A - Table 3 for Service Level Agreement information.) HBC employees made significant effort to ensure that this commitment to the company's customers was met. If a shipment missed its preferred carrier

pickup time, HBC would often upgrade an order calling for ground shipping to next day delivery.

D2C fulfillment clients were expected to have different shipping requirements from those of the traditional bookstore. Traditional bookstores were offered free shipping for orders over 100 units. Internet customers, on the other hand, selected their preferred method and speed of shipment types and paid the shipping cost themselves. In response to the proposed inclusion of direct fulfillment orders for Internet customers, HBC proposed to add FedEx and DHL as carriers, but the carrier pickup times would essentially remain the same as in the exiting large-batch system.

Tom realized that he needed to analyze the impact of the proposed direct fulfillment process changes on the operations at HBC. Clay suggested that HBC bring in an operations modeling company to determine the impact on the warehouse and its processes. Clay and his staff began to put together a Request for Proposal (RFP) for Operations Simulation Synergies (OSS), a nationally known operations modeling company. The RFP contained information detailing the current picking, packing and shipping processes and gave profiles of the current batch order flows as well as the anticipated order changes. Clay had no basis to change his expectations of this order profile once the Internet orders started to flow in.

Request for Proposal (RFP) for Process Analysis

Operations Simulation Synergies (OSS) was requested to perform two types of process analysis, one utilizing static spreadsheet analysis, and the other model being a dynamic simulation model. The objective was to compare the baseline "As-Is" process volumes, costs, and service levels versus the anticipated "To-Be" business processes in which half of the total consumption of books occurs via small single-book Internet orders, as depicted in Appendix A - Figure 6.

As part of the RFP request to OSS Clay included the following list of ground rules and objectives for the static spreadsheet model:

- Operations staff, known as "associates", cost $7.00 per hour with benefits costing an additional 33.0% of base salary.
- Large bookstore orders are 100 books. Small Internet orders are for 1 book each.
- Although the total volume of books purchased by consumers is not expected to change, half of the order volumes from before now become single-book Internet orders, as depicted in Appendix A - Figures 3 and 5. The expected average process volumes are shown in Appendix A - Table 4.
- Average process times are shown in Appendix A - Table 5.
- A utilization factor of 85% is used to convert labor hours to actual headcount, assuming at 15% of associate labor hours are non-production personal and support activities.
- Additional packaging materials for the small order T boxes are 30 cents per order.
- The objective is to compute differences in average staffing levels and cost per order.

Clay also included the following list of ground rules and objectives for the dynamic simulation model:

- Initially use the staffing capacity levels indicated by the static spreadsheet analysis, then study the sensitivity of system performance to various levels of staffing.
- Simulate system operation from 7a.m. until 1a.m. which covers the period of two shifts.

- Appendix A - Table 5 indicates the process time statistical distributions to use for purposes of modeling process time variability. The pick time (exponential distribution) has greater variability because of the nature of the task – wandering through aisles in the warehouse in a serpentine manner to locate and pull books from shelves.
- Orders are to be released at the times and quantities indicated in Appendix A - Table 6. Note that 50% of orders in each batch release are assumed to be large (i.e., 100 units) orders and 50% are small one-unit orders.
- The objective is to determine what percent of orders in each release batch arrive at the package carrier pickup area by the 5 p.m. pickup time for same day delivery to determine the impact on service level agreement performance.
- A second objective is to measure queue behavior before each process for purposes of sizing work station floor and conveyor space.

Waiting for Answers

OSS was hired to analyze the proposed process. As Tom waited on the consultant's report, he could not help but be anxious. He anticipated that the impact on the business, at all levels, would be significant. Besides the operational questions about staffing and capacity, level of delivery service, and cost, he wondered about the broader ramifications for the book industry and its traditional structure. Tom did not doubt that HBC would have to change. The OSS RFP response would be a catalyst to help Clay examine the changes proactively. Tom's operation team had met similar challenges in the past. But there was no looking back. The winds of change would either destroy an anchored ship, or else sail the ship to new worlds. Tom felt it was time to weigh anchor and sail.

TEACHING NOTE

Case Overview

Hodges Book Company (HBC) began the last decade of the 20th century as the premier wholesaler in the book industry. Its position had been solidified by significant systems development and the provision of next-day delivery to large portions of the traditional bookstore market. HBC made customer service to the bookstore its focus and had developed supporting programs that helped the individual retail bookstores be more successful in managing its business.

The advent of the Internet had a tremendous impact on the traditional book wholesaler. When HBC management committed to provide contract order fulfillment for an e-commerce book website, they struggled to anticipate the cost impact and operational changes they would encounter. Students are asked to model the operational process changes to the traditional business using static and dynamic methods and assess the broader industry competitive ramifications.

Course Applications

The case is directed towards courses in Logistics/Supply Chain Management and Operations Management with optional coverage of simulation modeling and queuing theory, depending on the level of the course.

Learning Objectives

1. To understand basic concepts and processes of distribution and order fulfillment.
2. To explore the impact of the transition from large batch order fulfillment processes to high volume single unit processes.
3. To apply modeling methodologies to help understand the transition from a traditional wholesaling business to a direct-to-consumer fulfillment system, including static spreadsheet analysis and dynamic simulation modeling.
4. To assess the broad impact of disruptive technology such as the Internet on business processes and competitive structure of an entire industry.

Questions and Answers

1. What impact might the transition to e-commerce size orders have on receiving, stocking, and picking operations at HBC?

The availability of the more obscure titles from HBC's inventory with fast delivery times might increase the demand for these slower moving items. If demand for these titles increases, reorder points will be activated sooner and receiving operations may experience an increase in small order receipts from publishers. Small orders require the same amount of receiving paperwork as a large order.

Stocking could also be impacted as these more obscure titles turn more often. The use of library type stocking shelves to stock these titles causes the stocker to spend more time

locating the exact location on the library shelf to place the title. This could result in increased stocking time and increase labor costs.

Internet orders do not follow traditional marketing campaigns found in individual book stores. Internet-driven demand for titles is more geographically widespread and can vary based on news stories, world events, and entertainment focus. The locations of HBCs warehouses, optimized for its traditional bookstore demand patterns, may not be optimal for Internet-driven orders from consumers all over the world. As local news events impact the consumer, HBC might find itself with sudden excess demand for titles in certain locations in the warehouse. Titles that are stocked as slow movers for the traditional business may move faster with the advent of Internet marketing. Picking congestion, extended picking paths, and increasing picking costs could become a problem.

The Internet-driven book demand is not linked to store opening times and store reorder cycles. In fact, it could be argued that the Internet frees the consumer to order at any time of the day or week. The effect on HBC's operations may be significant if there are peak order times and days that differ from the traditional book store demand profile. Clay should have asked for order profiles from the contract order fulfillment clients to better predict Internet-driven demand patterns.

2. **Discuss possible causes and corrective action of the current level of inventory data errors resulting in "slashes" from customer orders resulting in lower fill rates.**

One important metric for HBC was slashes – books that the system designated were in inventory but which were, in fact, not present in the predicted quantities. The impact of traditional fill rates and slash rates on new single unit e-commerce orders is ignored by Clay. New operations processes should be developed to ensure higher fill rates and lower slash rates so as to reduce the customer impact of "complete" order failure for e-commerce consumers.

Clay assumed that the preservation of the picking process was the best way to minimize impact on HBC's operations area. He fails to gauge the operational impact and costs that an additional sort process might have on the business. He should have left Operations Simulation Synergies (OSS) open to modeling new methodologies such as "pick to sort en-route". In a pick-to-sort-en-route system orders are picked in sequence and matched with their packing slips as they are picked. One problem with this solution is that HBC's assumption is that Internet-based orders will be single unit orders. Should multiple unit small orders become prevalent, then this process might have to be modified i.e. a picking cart with sort slots.

Improvements in inventory accuracy would facilitate improved order fill rates. These improvements could be achieved by the following:

- Mistake proofing the quantity verification upon receipt or the count at the time of picking/shipping.
- Cycle counting - randomly cycle count stock levels
- Real-time database updates instead of the current system of batch computer job database updates.

3. **From the data in the RFP, perform a basic sizing and cost analysis for the As-Is traditional bookstore ordering business model.**

Appendix B - TN-Table 1 summarizes an average staffing requirement computed from the As-Is system data in the RFP.

A typical order arrival rate for the As-Is (pre-Internet) baseline scenario is 50 large bookstore orders per hour. Using the process times from the case for each station, and a staff utilization factor of 85% (as directed in the RFP), the required staffing at each station is computed as follows:

Minutes per order * orders per hour / 60 minutes per hour /.85.

So, for example, the picking staffing = 60 minute process time per order * 50 orders per hour / 60 minutes per hour / .85 utilization = 58.8 people. The assumed 85% utilization factor recognizes that people cannot perform production activity 100% of the time.

Appendix B - TN – Table 2 computes the impact of the change in demand profile to half large 100-unit bookstore orders and half small orders from individual web customers. The small orders are assumed to be of size one unit. It is also assumed that for picking purposes, that 100 of the small orders are grouped into a large picking order for efficiency purposes. Therefore, there is no net change in the demand pattern for picking and counting. The demand is still 50 large orders per hour, recognizing that half of these are groupings of the smaller single unit orders. After counting, the picked orders are split out into 2 process streams as depicted in case Appendix A - Figure 5, one for large bookstore orders and the other for the small single unit web customer orders. So the net demand volume for the big order stations is half of the picking volume, or large orders per hour. The volume for the small order stations is 25 groups of 100 units each = 2500 single unit orders per hour.

A quick review of Appendix B - TN - Table 2 indicates that the total staffing of about 120 people is considerably higher than the baseline As-Is scenario of about 73 people. However, the cost of the increased staffing level of 47 more people will be distributed over a significantly greater number of orders. If we calculate the per-order cost for the small web customer orders using the cost data provided in the RFP, the labor cost increase per order is (47 more people * 7$ per hour base pay * 1.33 factor to include benefits costs) / 2500 orders per hour = about .18 or 18 cents per order. If we also include the T-box packaging costs of about 30 cents per order, we obtain a total cost increase of about 48 cents per order for the single unit orders. This cost delta could be included in the shipping and handling costs typically paid by the web customer.

4. (Optional question for courses using simulation) Model the processes using dynamic simulation software and examine the delivery time service level performance.

From a modeling perspective, a static spreadsheet analysis such as shown in Appendix B - TN Tables 1 and 2 are adequate for computing average volume, cost, and resource requirements for various planning scenarios. However, you cannot make any valid assessments of waiting times based on simple queuing formulas because of the complexity of the processes, variability in process times, and uneven arrivals of orders as released by the batch release scheduling. For a valid assessment of process and overall waiting and span times, dynamic simulation modeling is required. The span time of the orders in the system matters to Hodges because it affects their ability to meet customer expectations concerning same-day shipping of the orders are received by a certain time of day.

Appendix B - TN - Figure 1 shows a simulation model developed in the SIMUL8 (see www.SIMUL8.com) simulation modeling software. (Several such simulation software packages are available.) The process times and variability in each station are provided in Appendix A - Table 5 of the case. The important statistical results included process utilization of capacity (staffing levels) and the percentage of each order batch release group able to complete the entire order fulfillment process and be finished by 5pm to meet the expectation of same-day shipping for orders received before a certain time of day. Average and maximum queue data for each process would also be helpful in determining floor and conveyor space allowances.

For the baseline As-Is scenario with all large bookstore orders, Appendix B - TN-Table 3 shows a portion of the simulation results. Note that the average people working in each process does not include any extra allowance for non-production personal time as was factored into the results in Appendix B - TN- Tables 1 and 2.

The percentage of orders completing the entire sequence of processes and arriving at the shipping point by the 5pm pickup time (and thus available for next-day delivery) are shown in Appendix B - TN-Table 4. This level of performance is consistent with the historical levels of performance reported in Appendix A - Table 3 of the case.

Now, the Internet order scenario was simulated in which half of the orders after the counting station were split into 100 individual customer orders and processed in the small order line. The overall process capacity utilizations were unchanged from the baseline scenario. The other process utilizations of staff are shown in Appendix B - TN-Table 5.

The percentage of orders ready for shipping pickup by 5p.m. and thereby capable of next day delivery, using the exponential pick time distribution and normal pick distributions as used in the baseline scenarios, are shown in Appendix B - TN-Table 6.

These results show that the To-Be Internet scenario (half small orders) does somewhat reduce the ability to process the orders all the way to the shipping pickup point by 5p.m., although most of the degradation was in the 2:30 batch release that had no expectation of next-day delivery under prior agreements with bookstores.

5. (Optional question for courses discussing queuing theory) Use the simulation model to examine the sensitivity of the results by varying such parameters as process staffing levels and process variability. Compare your results with that predicted by queuing theory.

For a thorough discussion of process capacity utilization and process variability and their effect on process queuing, the student should reference Hopp and Spearman (2000) and Cachon and Terwiesch (2006). Queuing theory formulas for anything other than the simple case of exponential arrivals, exponential service times, and a single server get rather complex, but waiting times and queue length are, in the general case, functions of three major factors:

- Variability of arrival of demand and process times (V)
- Capacity utilization of the staff (U)
- The process time itself (T).

Hence the general case queuing equations for computing average queue length and wait time are known as VUT formulas. An increase in any of these V, U or T parameters will increase the average queue length and wait times. In the context of HBC, those

increases would delay the final arrival of a filled order to the carrier pickup area by 5 p.m. thereby impacting the service level performance.

As an example of such an analysis, an alternative scenario was executed in which process improvements in picking were assumed to have reduced process variability. A normal distribution was used with the same mean time (60 minutes), but a standard deviation of 12.5 minutes was used, which is a Coefficient of Variation (CV) = 12.5/60 =.25 as compared to the previous exponential assumption, which has CV = 1.0. Appendix B - TN-Table 7 summarizes the resulting impact on completion of the orders. The capacity utilizations are the same as in the previous scenario; however there was an improved ability for the orders to meet the 5pm shipping pickup time:

6. What impact might HBC's pioneering operations changes have on their reputation in the industry and how might it affect their competitors?

HBC was in an operations pioneering position. They chose to develop operational systems to support their strategy of providing contract order fulfillment on behalf of Internet book sellers. Leadership in this industry would be possible by streamlining the value activity sought by the fulfillment customers. Michael Porter's discussion of leadership and "followship" in his book Competitive Advantage (1985) applies here.

HBC chose operations leadership with a focus on cost advantage and differentiation. By definition they chose to "Pioneer a unique service that increases buyer (fulfillment customer) value". They did this by innovating in their services to increase the buyer value. As a first mover, they were well on their way to reducing the costs of operations through experience.

Further analysis of the leadership (or First Mover) model should examine the sustainability of the lead. Porter indicates that while innovation is important, even more important is to innovate faster than your competitors. Porter says "The second condition (innovate faster) is important, because technology often diffuses, requiring a technology leader to remain a moving target." If HBC hesitated in providing these new operations services, they could become a stationary target for their competitors. Some competitive advantage would be lost as other wholesalers entered the industry.

Student discussion should also center on First Mover advantages with regard to:

a. Reputation**:** HBC appears as a pioneer in the industry and leverages its existing HBC wholesale reputation.
b. Switching Costs**:** As a First Mover there is a cost of re-working connectivity with other fulfillment service providers. This can lock in fulfillment customers as they develop their new systems and work closely with HBC and their operations processes.
c. Proprietary Learning Curve**:** By being the first in to a new industry you learn the pitfalls of entry prior to your competitors. This experience can be leveraged as competitors wade through the same problems experienced by HBC.
d. Definitions of Standards**:** As a first mover HBC would be able to define many of the requirements to seamlessly recreate a fulfillment customer's business paperwork in house. This tight level of integration, combined with the first mover benefit, could prove to be a strategic advantage for HBC. Wholesale competitors who could not handle new standards might be left out of the loop.

First Mover Disadvantages also exist:

a. Pioneering Costs: The cost of producing operations processes separate from the traditional HBC business might be high. Discussion might center on how this could be viewed as research and development costs for HBC.
b. Changes in Buyer's Needs**:** As services came online, the Fulfillment customers could see the benefits of additional services being provided by HBC. Discussion with the students should center on "Scope Creep" where initial requirements often expand and become more complicated as the business relationship develops.

The key words to examine in the HBC case are "Sustainable Advantage." Early choices can set management on a course where sustained advantage might have to be put on hold.

Whatever the student's response, it should acknowledge the desire of the leadership of HBC to maintain an emphasis on service quality and should document how it will optimize the twin goals of customer satisfaction and profitability. It may be necessary to remind the student that, for HBC, the customer is the retailer, whether a traditional brick-and-mortar retailer or an online retailer.

7. What possible future developments might be seen in the e-commerce fulfillment industry and how might this affect the planned operations changes at HBC?

Disintermediation may occur if publishers developed their own fulfillment systems or partners. Disintermediation would place HBC at an extreme disadvantage. Currently the number of publishers required to supply the 500,000 titles is extremely high. However, many of the larger publishers are considering developing the ability to fulfill consumer orders on behalf of e-commerce vendors.

Possible changes in pricing shipping transactions may also facilitate the disintermediation of the wholesaler. Currently, wholesale distributors enjoy economies-of-scale pricing advantages with the shipping carriers because the distributors ship such high volumes from a common location. But if shipping carriers (e.g. FedEx, UPS, and USPS) modified the pricing model for shipments to be based on volume shipped to a destination location rather than volumes from the shipping pickup location, the wholesale distributors would lose their economy-of-scale shipping cost advantage. With this cost advantage removed, e-commerce sites could negotiate better discount rates directly from the publisher, possibly cutting out the wholesale distributor.

Other technologies related to the Internet and the digitizing of books are print-on-demand (POD) and e-books. The print-on-demand model is that books are not printed until actually ordered by a customer. While there is a higher variable cost per book to print quantities of one, there is a much smaller investment in fixed cost infrastructure – warehouses, material handling equipment, computer systems, etc. E-books are relatively inexpensive laptop computer-like devices for reading books whose content exists in digital form. Students should research print-on-demand and e-books and discuss possible future scenarios for the book publishing, printing, distribution, and retailing industry.

Optional Study of the Order Fulfillment Industry

8. Discuss the pros and cons of a firm utilizing a 3rd party order fulfillment company instead of performing these activities in-house.

The student should search for terms such as "order fulfillment", "fulfillment house", "contract warehousing", third-party logistics ("3PL"), and other related terms on the Internet and note the purported benefits of firms utilizing the services of 3rd party order fulfillment firms. In the 3rd party order fulfillment model, a firm ships products from its suppliers to the order fulfillment company's distribution center which stocks the items and then responds to customer orders by picking, packing, and shipping the items directly to the purchasing customer. The fulfillment center may also perform a returns management function by receiving unwanted or defective product back from the customer, evaluating the returned product and then either initiating disposal or else re-stocking the items for future purchase and triggering the appropriate financial transactions. Other possible services include the staffing of a call center or website support to receive customer orders. The fulfillment center might also perform final assembly, thereby "postponing" the final assembly of various possible customer options until just before shipping, thereby reducing the number and types of stored stock keeping units (SKUs) in inventory.

The possible advantages of using a 3rd party order fulfillment company include:

- Economies of scale with warehouse space, staffing, material handling equipment, WMS information systems and carrier shipping rates
- More flexibility in location of Distribution Centers
- Expertise in DC operation and in information systems integration with partner firms.
- Returns handling
- Can perform customizing manufacturing assembly before shipping

Disadvantages might include:

- Potential loss of control,
- Being blamed for the mistakes made by an invisible order fulfillment firm
- Lack of communication with your own firm's marketing organization regarding sales promotions. The order fulfillment provider may be surprised and overwhelmed by sudden increases in customer orders related to a marketing organization's promotions.

References:

Cachon, Gerard and Terwiesch, Christian (2006) Matching Supply With Demand: An Introduction to Operations Management, McGraw-Hill, NY.

Hopp, Wallace J. and Spearman, Mark L. (2000) Factory Physics: Foundations of Manufacturing Management, McGraw-Hill, NY.

Michael Porter, (1985) Competitive Advantage, Creating and Sustaining Superior Performance, page 181 and 183, Free Press, NY.

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Appendix A – Student Case Tables and Figures

Table 1 – Inventory Location Types and Functions

Inventory Location	Description	Usage	Location Relationship	Quantities
Overflow	High rack – Pallet level storage	Storage for overflow items – not needed within several days.	One location could store one item or multiple items	Pallet quantity, full Case or Broken Case
Library Shelving	Vertical book storage	Storage for small quantity stocks of books – typically slow moving titles, i.e., those that retail bookstores ordered in quantities of one and two.	Located on the top shelf of all regular storage bin locations throughout the warehouse.	Individual Units in Vertical Storage (similar to books in library shelves)
Fast Mover	Pallet Location	Fast moving new release titles stored in case quantities	Located at the front of the warehouse close to packing area for fast pick and pack.	Full Case, Broken Case, or Individual Units
Regular Shelving	Warehouse shelf locations	Storage for medium mover titles.	Located between Fast Mover and Overflow storage. The bulk of titles were stored here.	Individual units in horizontal storage.

Table 2 – Order Processing Run Times (Central Standard Time)

Picking List Run #	Time Released to Warehouse
1	10:30 a.m.
2	12:30 p.m.
3	2:30 p.m.
4	5:00 p.m.
5	8:00 p.m.

Table 3 – Delivery Service Level Requirements and Performance

Order Run Time	Delivery Guarantee	Actual Performance to Guarantee
10:30 am	Next Day	99%
12:30 pm	Next Day	99%
2:30 pm	2 day	100%
5:00 pm	2 day	100%
8:00 pm	2 day	100%

Table 4 - Average Hourly Process Volumes

Process	As-Is Scenario Demand – Avg. Orders per hour	To-Be Scenario Demand – Avg. Orders per hour
All Orders		
Picking	50	50
Counting Verification	50	50
Big Bookstore Orders		
Packing	50	25
Manifesting	50	25
Shipping Preparation	50	25
Small Consumer Orders		
Sorting	0	2500
Packing	0	2500
Manifesting	0	2500
Shipping Preparation	0	2500

Table 5 – Process Time Parameters

Process	Process Time (Average Minutes per order)	Process Time Distribution
Large Order Picking	60.0	Exponential
Counting Verification (both large and small)	5.0	Normal, standard deviation = 25% of mean
Small Order Sort	0.1	Normal, standard deviation = 25% of mean
Large Order Packing	8.0	Normal, standard deviation = 25% of mean
Small Order Packing	0.4	Normal, standard deviation = 25% of mean
Large or Small Order Manifesting	0.5	Normal, standard deviation = 25% of mean
Large or Small Order Shipping	0.6	Normal, standard deviation = 25% of mean

Table 6 - Batch Order Release Schedule and Quantities of Orders

Order Release Batch Printing Time	Number of Large 100 Unit Orders Released	Number of Small Single Unit Orders Released
7:00 am (assumed left over from prior evening)	75	75
10:30 am	50	50
12:30 pm	50	50
2:30 pm	50	50
5:00 pm	100	100
8:00 pm	75	75

Figure 1 - Existing Process Overview

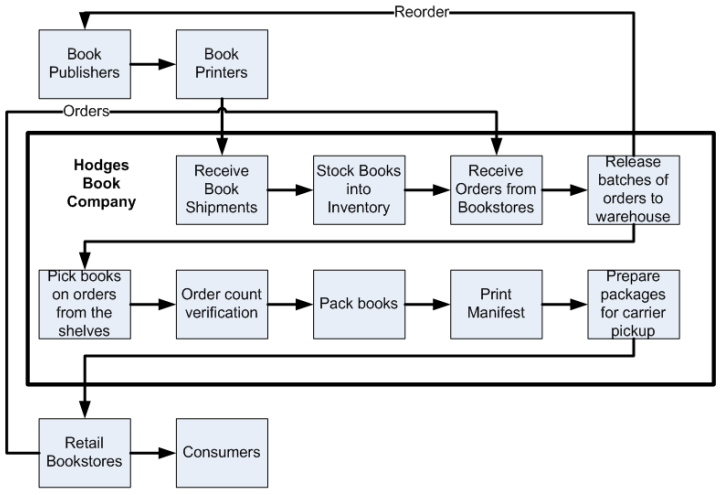


Figure 2 – Warehouse Layout and Pick Paths

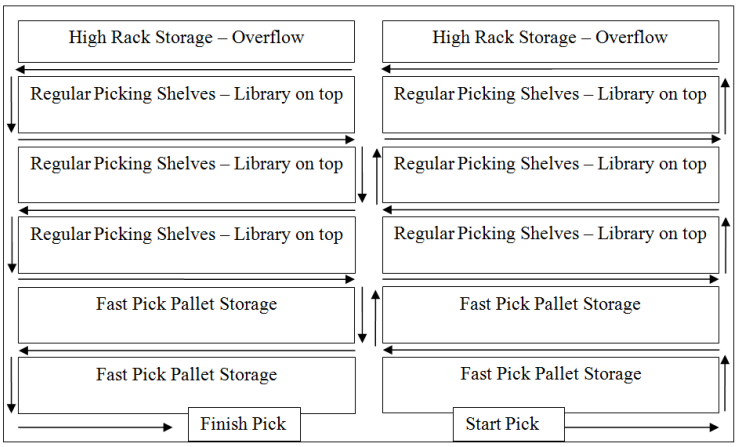


Figure 3 - Comparison of Hourly Flow Volumes for Traditional Bookstore Model versus Future Mix of Traditional Bookstore and Direct Consumer Order Fulfillment

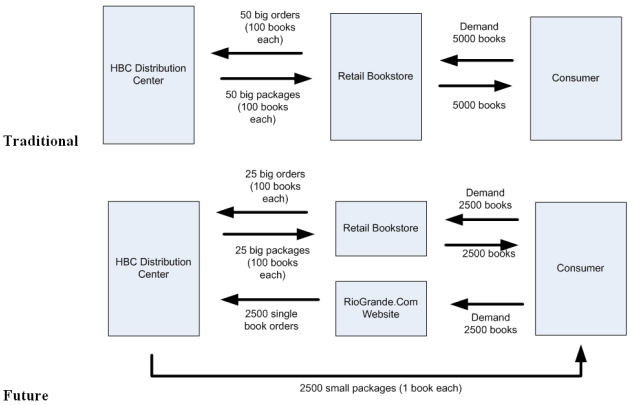


Figure 4 – Proposed Picking Order Disaggregation Sort Process

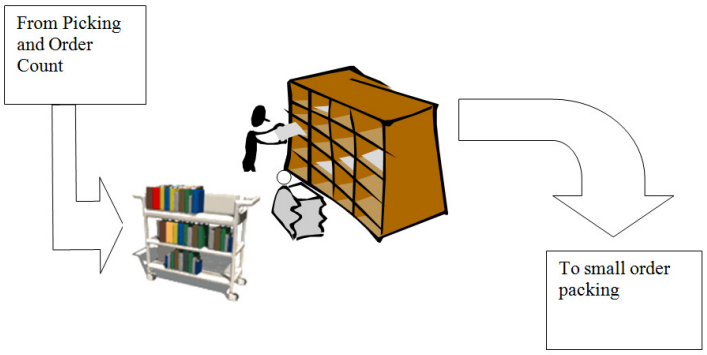


Figure 5 – T-Box Packing Process for Small Orders.

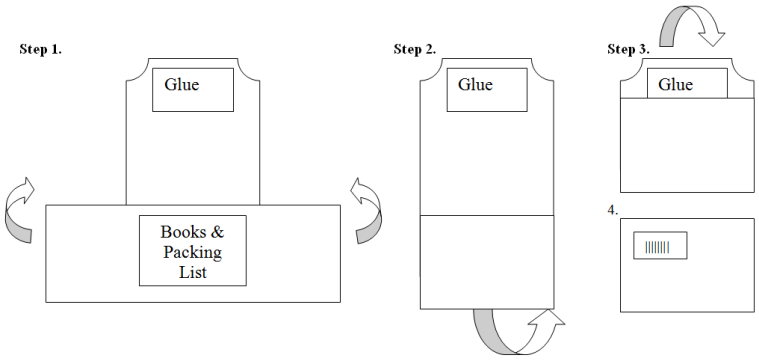
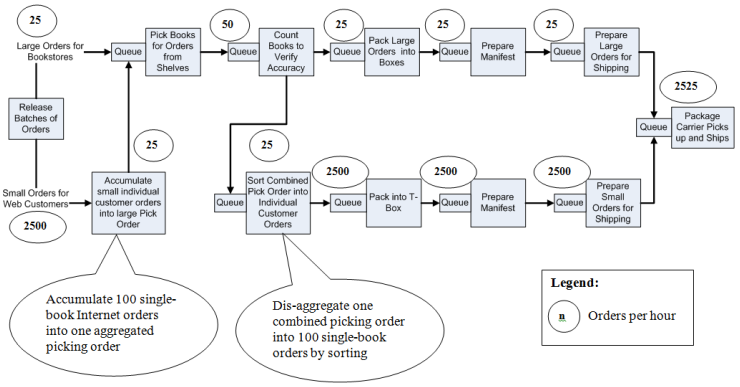


Figure 6 - Proposed "To-Be" Process



Appendix B – Instructor Case Teaching Note Tables and Figures

TN - Table 1 - 1996 Hodges Book Company
Process Data Baseline – All Big Orders

Process	Minutes Per Order	Demand - Orders Per Hour	Required Staffing
All Orders			
Picking	60	50	58.8
Counting	5	50	4.9
Big Orders			
Packing	8	50	7.8
Manifesting	0.5	50	0.5
Shipping	0.6	50	0.6
Total			**72.6**

TN - Table 2 - Hodges Book Company Process Data with
Mix of Big and Small Orders

Process	Minutes Per Order	Demand - Orders Per Hour	Required Staffing
All Orders			
Picking	60	50	58.8
Counting	5	50	4.9
Big Orders			
Packing	8	25	3.9
Manifesting	0.5	25	0.2
Shipping	0.6	25	0.3
Small Orders			
Sorting	0.1	2500	4.9
Packing	0.4	2500	19.6
Manifesting	0.5	2500	24.5
Shipping	0.06	2500	2.9
Total			**120.1**

TN-Table 3 - Average Number of Associates Working in Each Process in As-Is Scenario

Process	Capacity (people)	Avg. People Busy
Picking	60	48.6
Counting	5	3.9
Big Order Packing	8	6.3
Manifesting	1	.4
Prep for Shipping	1	.44

TN-Table 4. Percentage of Each Batch Order Release Completed for Next Day Delivery in the As-Is Scenario

Order Release Batch	Percent Complete by 5pm Carrier Pickup for Next Day Delivery
7:00 am	100%
10:30 am	99%
12:30 pm	98%
2:30 pm	86%

TN-Table 5 - Average Number of Associates Working in Each Process in To-Be Scenario

Process	Capacity (people)	Avg. People Working
Big Order Packing	4	3.1
Big Order Manifesting	1	.2
Prep for Shipping	1	.23
Small Order Sort	5	3.76
T-box pack	20	14.9
Small order manifest	25	19
Prep for Shipping	3	2.29

TN-Table 6 - Percentage of Each Batch Order Release Completed for Next Day Delivery in the To-Be Scenario

Order Release Batch	Percent Complete by 5pm Carrier Pickup for Next Day Delivery
7:00 am	100%
10:30 am	100%
12:30 pm	97%
2:30 pm	78%

TN-Table 7 - Percentage of Each Batch Order Release Completed for Next Day Delivery in the To-Be Scenario with Reduced Picking Process Variability.

Order Release Batch	Percent Complete by 5pm Carrier Pickup for Next Day Delivery
7:00 am	100%
10:30 am	100%
12:30 pm	100%
2:30 pm	92%

TN - Figure 1 - Screen Image of the SIMUL8 Simulation Model