Packaging process: When should it occur

Paula Raney

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Packaging Process

When Should It Occur

By

Paula Raney

Thesis

Submitted to the
Department of Packaging Science
College of Applied Science and Technology
In partial fulfillment of the requirements
For the degree of
MASTER OF SCIENCE
Rochester Institute of Technology
2002
The M.S. Degree thesis of Paula J. Raney has been examined and approved by the thesis committee as satisfactory for the thesis requirements for the Master of Science Degree.

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August 5, 2002
Title of the Thesis: PACKAGING PROCESS, WHEN SHOULD IT OCCUR

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Date: August, 2002
Dedication

I would like to dedicate this work to my family for their patience for all the time they had to fend for themselves while I flew to New York to attend classes or long lonely nights while I researched and wrote this paper.

I would also like to recognize my dearly departed mother whose wonderful support and encouragement started me on this quest.
Abstract

The purpose of this thesis was to determine whether John Deere's packaging process needed to be streamlined, and whether consideration should be given to engaging the packaging department earlier in the product development process. An IMPACT study produced a flowchart of the current packaging system, which identified gaps in the current packaging process. Evaluation of the IMPACT study isolated the packaging process areas that needed to be modified to create an improved packaging decision process. A survey was then given to several thousand Deere dealers to determine whether Deere’s packaging and delivery of service parts was meeting customer expectations. The survey results provided a favorable response, but also indicated that there was room for improvement by identifying families of parts, which required some packaging modifications to better protect the service parts.
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Introduction

As companies struggle to stay competitive, some of the oldest companies in the U.S.—such as 3M, DuPont, GE, Rubbermaid, and Deere—have met the challenge by developing a continuously sustained commitment to innovation in their products.

Deere and Company began as an agricultural implement manufacturer 166 years ago with the invention of the self-scouring plow by founder John Deere in Moline, Illinois. Deere and Company has grown into a major supplier of construction, forestry, grounds care, and other specialized machinery, which has helped them to expand the business into a global organization. Deere has one of the largest equipment finance leasing operations in the United States and is becoming a force in Health Care. In 2000 Deere was top ranked in the Industrial and Farm equipment category of Fortune magazine’s “America’s Most Admired Companies” (www.johndeere.com). Deere and Company creates smart and innovative solutions in the form of advanced machines, services, and concepts for their customers. However, Deere needs to push these innovative solutions into the packaging arena.

At the February 2002 annual stockholder meeting, Deere CEO Robert Lane stated that new products had been the focus in 2001. As a matter of fact, it was the biggest new product year ever for Deere. New product lines translate into new service parts, which are a big part of Deere’s business. Last year John Deere’s service parts sales exceeded $1.9 billion worldwide. The company’s strong distribution system helps it provide timely and efficient delivery of equipment parts, accessories, and merchandise to John Deere regional dealers and customers throughout the world. Customer loyalty and satisfaction drive Deere to continue to provide the
same great service part delivery worldwide. Multi-generation John Deere agricultural equipment owners reflect customer trust and loyalty to the Deere product. New product development and acquisitions present an opportunity for Deere to build on its reputation for integrity and product value. However, the rapid growth of the company through acquisitions and new product development presents a challenge to Deere to remain competitive and still provide the same excellent service parts delivery to its customers.

As John Deere's business has evolved from manufacturing and assembly to purchased product and assembly, the role of packaging has changed, too. New product growth brings new materials and technology, which mandate new packaging requirements. More than ever, Deere needs to manage the packaging function in order to continue to project a corporate image of excellence.

Managing the packaging function at Deere, as with any large manufacturing company, can be a very complex endeavor. Packaging is part of a bigger picture of providing products to a consumer. Walter Soroka (1999) states that every activity in the manufacturing process has an impact or demand on packaging. Production, purchasing, receiving, warehousing, material handling, marketing, shipping, and distribution all have particular packaging demands. Any small change in the packaging can impact other areas. For example, a change in a package size can be detrimental to pallet utilization, storage efficiencies, and truck cubing. The package designer must meet the challenge to provide for everyone's needs and still keep packaging prices down and profits up. However, the process of bringing product and packaging together is often the last step of the product manufacturing operation.
Packaging has different degrees of importance depending on which discipline in the manufacturing process is viewing it. For Deere, packaging is an important link in the distribution chain, which places the product in the hands of the consumer. Packaging is designed to help transport, contain, and preserve Deere's product. The Consumers and Commercial Equipment (C&CE) Division sees packaging as a marketing tool, a way to sell the product and provide the end user with information regarding the use of the product. Both John Deere's Construction and Forestry Division (C&FD) and Agricultural Division (AG Division) see packaging as a non-value-added cost of doing business. The product needs to be delivered to the consumer without damage or contamination. The legal staff views packaging as a means to meet Federal regulations related to country source of origin, the Hardware Fastener Act, and D.O.T. (Department of Transportation) Regulations.

An article in *Packaging Digest* by Mary Ann Falkman (2001) discussed a study that was commissioned by the Packaging Management Council to raise the visibility of the packaging function and its importance in companies. The study surveyed Fortune 500 companies to discover how companies organize and run the packaging function. The results indicated that in many cases packaging seemed to be viewed as an unwanted stepchild. Many companies saw packaging simply as an expense of doing business. Senior management often could not provide a clear statement as to who was responsible for the packaging function nor was there a clear management organization or structure of the packaging function. This situation holds true at Deere as well. The packaging function crosses a wide variety of departments: purchasing, methods engineering, warehouse operations, quality, and shipping. The "home" for packaging at
Deere could have ended up in any one of these departments, but it resides with the External Operations Division in the off-site Packaging Department.

**History of John Deere Parts Distribution Center (JD PDC)**

There are three main categories of packaging: consumer, industrial, and institutional. Deere’s service parts packaging falls into the industrial category. Industrial packaging is used to protect, store, and transport a product to the customer. Walter Soroka’s (2001) describes packaging as “a coordinated system of preparing goods for transport, distribution, storage, retailing, and use.” This definition captures the essence of packaging, which the John Deere Parts Distribution Center (PDC) provides for John Deere today. It is the job of PDC to combine all the different Deere divisions’ packaging concerns and strategy in the most economical and efficient packaging method for all. PDC provides a centralized packaging operation for more than 400,000 SKU of the John Deere product lines. It does not attempt to package for retail sales, but still stores and transports those products worldwide so the secondary package is also important to the company.

Up until 1977, each Deere facility handled its own packaging of both whole goods and service parts. Shortly after the opening of the service parts warehouse in Milan, Illinois, it was discovered that Deere did not have any consistency in its packaging from one factory unit to another. Even through PDC was built as a centralized worldwide distribution center, it was decided that it would also be economical to centralize Deere service parts packaging under one roof at PDC. Service parts packaging was not a new idea for Deere, but the concept of centralizing packaging operations was. Each factory had its own ideas and ways of packaging its
product. Since all service parts were stored at PDC, by handling all the packaging at one main location Deere could reduce packaging engineering staffs, increase price breaks by leveraging packaging material purchases from a few regional suppliers, and reduce handling damage.

Currently, PDC's packaging operation is administrated by the External Operations Department, which coordinates packaging specifications for all three contract packaging companies. Deere's packaging operation is based on John Deere packaging guidelines, industry standard, and company best practices.

In order to provide a corporate packaging guideline for all factories to follow, a committee was formed with representatives from all Deere factory units and corporate marketing to discuss what it was that they wanted and needed from packaging. The first written document, *Preparation and Packaging of Service Parts* (better known at Deere as the *JDV9 Manual*), was published in 1978. As stated on page 2 of the manual, its purpose was “to establish standard identification, packaging, and handling procedures and guidelines.” The *JDV9 Manual* promoted (and continues to promote) the standardization of packaging material and the use of consistent standard packaging practices within a family of parts. Deere also wanted to promote a theme of corporate identification for worldwide merchandising to their customers. The company wanted every Deere dealership to look and feel the same way regardless of its location in the world.

Simply having the right part delivered on time will not satisfy Deere's dealers if the part is not salable, nor does it build customer satisfaction and loyalty if the part is not in mint condition. In order to effectively meet the growing packaging challenges that Deere faces, new packages types
must be developed that can withstand the rigors of today’s storage, shipping, and handling environments.

**Problem Statement**

At Deere, service parts packaging is not being considered early enough in product development so that it can be addressed before a product is shipped to PDC for packaging and programs are released to customers. Case studies will illustrate the impact that this lack of up-front packaging planning has on Deere customers, both internal and end user.

**Purpose**

The purpose of this study is to determine whether or not the current Deere and Company packaging development process needs to be improved.

**Limitations**

Deere’s *JDV9 Manual* provides the general information for setting up packaging, but it does not provide all the product information necessary to complete the packaging analysis. Also, the decentralized nature of the Deere organization makes it very difficult to make packaging changes for one division without affecting all divisions.

**Assumptions**

Two main assumptions regarding service parts packaging at Deere will be addressed: (1) The current packaging development process needs to be streamlined, and (2) that Deere customers are satisfied with the quality of service parts.
The Need to Streamline the Packaging Development Process

To validate the assumption that Deere’s current packaging development process needed to be streamlined, Alec Alessandra from the Construction and Forestry Division (C&FD) championed a cross-functional team that was created to analyze the current part adoption procedures in C&FD. At the first meeting (held in Dubuque, Iowa), the team started by creating a process map, which is a flowchart that tracks individual production processes. In this case, the mapping process was related to part adoption and the actions in the process that relate to service part adoption and how it impacts packaging. The team was also charged with identifying those actions in the process that would have to be modified to include packaging needs. The multidisciplinary team approach was used to address both purchased and manufactured service parts. As the team began mapping the initial part adoption process, several gaps in the service part adoption process were quickly identified. Once identified, defining and modifying gaps in the process could begin. It was noted that service part packaging, painting, and preserving requirements needed to be considered prior to a part being quoted by the supplier so the supplier could correctly bid the job. The use of a multidisciplinary team and process mapping provided great insight into the part adoption process and what areas were affected besides packaging. The approach proved to be a good representation of a real-world practice in the manufacturing industry. Figure 1 shows a copy of the process map.
Figure 1. Dubuque Flowchart
The most significant insight into this mapping process was that service parts packaging was not considered at all in the initial part adoption and manufacturing process. Once the team had developed a new process to address the gaps in the process, they addressed any negative effects this broken process may have caused by looking at warranty claims.

Appendix A shows an example of one such warranty claim, which revealed a service part-packaging problem. A factory employee who was processing a warranty claim on a piston for the sixth straight month discovered this problem. Further investigation showed that John Deere was paying $3,000 per month in warranty claims on one piston. The factory quality engineer called PDC to discuss packaging. PDC was told that this piston was a critical part with highly machined surface, yet it was being shipped to PDC for individual packaging in a plastic tote without any inter-packaging to protect the part in-transit. The parts were being banged together with every bump in the road. When the parts arrived at PDC’s contract packagers, they were already damaged. The fact that this part was highly machined and very prone to handling damage would have been very helpful to know when packaging was being set up for this service part. However, the packaging coordinator made packaging assumptions, based on the factory inbound packaging, that this part was not a critical surface so no special care was needed during primary individual packaging operation. The parts were dumped on a metal worktable, adding to the damage, before being wrapped in VCI paper and placed in a carton. Once PDC was able to discuss the problem with the engineer, the factory was able to adjust its inbound packaging. The factory added plastic egg-crate dividers to the plastic transportation tote pans to separate and protect the parts. PDC also upgraded their packaging process by adding notes to the routing
specifying that critical surface parts should not be dumped on the workbench, as well as upgrading the carton to a corrugated carton to provide better part protection.

A similar mapping process was done in the Agricultural Division at the Waterloo Tractor facility to identify their service part adoption and packaging process gaps. The cross-disciplinary team first met during Waterloo Works' Quality Week. The team was comprised of people from Supply Management, Materials, Engineering, and PDC's external packaging operations. At the first meeting, tools from Juran and IMPACT were used to map the service part adoption and packaging process. Discussions seemed to focus on why so many service parts needed to be reworked before they could be stocked on PDC's shelves as salable parts. This team chose to use an outline format instead of a flowchart to identify the problem areas and to work to correct the situation.

The Waterloo Works Team also used a different approach to correct process gaps. They chose to review monthly Salvage (rework of defective parts) Reports from PDC. These reports are used to alert the factory units of packaging problems so they can be addressed with suppliers in a timely manner. The example in Table 1 shows that paint and inadequate packaging were the two most frequent reasons for rework on Waterloo service parts for fiscal year 2001. Waterloo used this as a focal point for improvement. The team determined that they could resolve 67% of their rework problems by improving how they communicated paint and packaging requirements to their supplier.
Table 1. Waterloo Salvage Recap

<table>
<thead>
<tr>
<th>REASON</th>
<th>CODE</th>
<th># OF PARTS</th>
<th>% OF TOTAL PARTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUSTY</td>
<td>1</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>USED/RGA</td>
<td>2</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>BENT/SCRATCHED OR DENTED</td>
<td>3</td>
<td>1</td>
<td>0.03%</td>
</tr>
<tr>
<td>CARTON DAMAGE</td>
<td>4</td>
<td>24</td>
<td>6.60%</td>
</tr>
<tr>
<td>CONCEALED DAMAGE</td>
<td>5</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>KIT MISSING COMPONENTS</td>
<td>6</td>
<td>1</td>
<td>0.03%</td>
</tr>
<tr>
<td>NO I.D./WRONG IDENTIFICATION</td>
<td>7</td>
<td>54</td>
<td>14.80%</td>
</tr>
<tr>
<td>PACKAGE QUANTITY</td>
<td>8</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>PAINT</td>
<td>9</td>
<td>119</td>
<td>32.70%</td>
</tr>
<tr>
<td>PRESERVATIVE</td>
<td>10</td>
<td>1</td>
<td>0.03%</td>
</tr>
<tr>
<td>INADEQUATE PACKAGING</td>
<td>11</td>
<td>121</td>
<td>33.20%</td>
</tr>
<tr>
<td>MISCELLANEOUS</td>
<td>12</td>
<td>43</td>
<td>11.80%</td>
</tr>
<tr>
<td><strong>TOTAL SALVAGES</strong></td>
<td></td>
<td><strong>364</strong></td>
<td></td>
</tr>
</tbody>
</table>

Analysis by both cross-functional teams from the C&FD and AG divisions validated the first assumption that the service parts packaging development process needed to be streamlined to meet product and program release deadlines. Not only did the teams find gaps in the service part adoption process, but it also became apparent that the materials and technologies that John Deere was using in new product line had changed since the early 1970's. Innovative technologies such as global positioning and programmable engine control panels would require an entirely different set of packaging guidelines as compared to the old instrument panel packaging guidelines.
The Effects of Attitude on the Packaging Function

An article in *Packaging Digest* by Mary Ann Falkman (September 2001) is based on a benchmark study, which was commissioned by the Packaging Management Council to look at the structure and organization of the packaging department within large corporations. The purpose was to provide a forum for the discussion and study of trends that could improve packaging operations. The study found an amazing degree of diversity. A total of 34 respondents completed an extensive questionnaire on corporate packaging organization. Respondents tended to be managers or directors, with some senior packaging engineers and vice president also participating.

The questionnaire asked participants to rate their company's overall attitude toward packaging and the packaging function. Table 2 shows the results of one section of the questionnaire regarding perception of packaging function.
Table 2. Perception Statement Results*

<table>
<thead>
<tr>
<th>PERCEPTION STATEMENT</th>
<th>ALWAYS</th>
<th>SOMETIMES</th>
<th>RARELY</th>
</tr>
</thead>
<tbody>
<tr>
<td>We strive to be very innovative and in the forefront of new technology</td>
<td>45%</td>
<td>52%</td>
<td>3%</td>
</tr>
<tr>
<td>Cutting and containing packaging costs are primary goals</td>
<td>79%</td>
<td>18%</td>
<td>3%</td>
</tr>
<tr>
<td>Packaging is critical to the sales of our products</td>
<td>61%</td>
<td>30%</td>
<td>9%</td>
</tr>
<tr>
<td>As long as the package protects the product and has no negatives, it is doing its job</td>
<td>33%</td>
<td>48%</td>
<td>18%</td>
</tr>
<tr>
<td>The packaging department is very important in our company and is treated like a key player</td>
<td>48%</td>
<td>45%</td>
<td>6%</td>
</tr>
<tr>
<td>Our company commits major development and capital money to packaging projects</td>
<td>45%</td>
<td>36%</td>
<td>18%</td>
</tr>
</tbody>
</table>

(*from Packaging Digest, August 2002, p. 76)

Gouliard explains, "The survey results give me a better perspective of the packaging organization landscape across industries. The results provide a benchmark for various factors that drive packaging organizations: cost savings versus innovation, centralized versus decentralized, large versus small (Falkman, August 2001)." With their decentralized organization, it is apparent that Deere fits the profile of a large company and their packaging structure. Deere could have easily been one of the companies that participated in the Packaging Digest benchmark study. This article helped clarify Deere’s packaging function. Deere may state that the main purpose of packaging is part protection, but the main focus of PDC’s packaging operation is packaging cost reduction.
In this same article, Nieder explains his ideal of the four functions of a package department. He explains: “There are four functions of the packaging department. The number one priority is packaging development. Second, develop clear specifications: once that is done, it's done. Third is technical service and support- in order words, make the package run on the machinery. Then, finally, as the product matures, take costs out of the System (Falkman, August 2001).” The questionnaire results in Table 3 below confirm that Nieder's statement holds true for the large companies surveyed.

Table 3: *When Does Packaging Get Involved in New Projects*  

<table>
<thead>
<tr>
<th>WHEN DOES PACKAGING GET INVOLVED IN NEW PROJECTS?</th>
<th>ALWAYS</th>
<th>SOMETIMES</th>
<th>RARELY</th>
</tr>
</thead>
<tbody>
<tr>
<td>We initiate the new packaging concept ourselves</td>
<td>44%</td>
<td>53%</td>
<td>3%</td>
</tr>
<tr>
<td>New product or package conception by other group</td>
<td>24%</td>
<td>65%</td>
<td>12%</td>
</tr>
<tr>
<td>When the company commits to the project</td>
<td>50%</td>
<td>32%</td>
<td>18%</td>
</tr>
<tr>
<td>First team or project major meeting</td>
<td>50%</td>
<td>47%</td>
<td>3%</td>
</tr>
<tr>
<td>When the product is finalized</td>
<td>21%</td>
<td>26%</td>
<td>53%</td>
</tr>
<tr>
<td>Close to product launch</td>
<td>15%</td>
<td>18%</td>
<td>68%</td>
</tr>
</tbody>
</table>

(*from Packaging Digest, August 2001, p.71)

The results from this survey also hold true for the Deere organization. Deere does not consider packaging as an important part of a project until close to product launch. This attitude is demonstrated in the case studies described below that involve three new acquisitions made by Deere in the last four years. Deere purchased companies with product lines to compliment its
own products. However, this process of growing the business through acquisition has caused many challenges and problems regarding the packaging needs of the new product line.

Case Study #1: Bell Joint Venture

In 1998 John Deere's Construction Division began a joint venture with Bell Truck, Inc. Deere was looking for a line of articulating dump trucks to complement its industrial equipment line of bulldozers, scrapers, and backhoes. The distribution of the service parts to support the new line of equipment fell to the John Deere Parts Distribution Center in Milan, Illinois. The project faced several challenges. The first was that John Deere Construction Division did not bring PDC into the planning stages of the project with the full outline of their special packaging requirements. Six months before PDC was scheduled to receive some 7,200 service parts, PDC was told that it would be responsible for the distribution of all service parts, not only to Deere dealers but also Bell Truck dealers. This short six-month window for operations, as well as the lack of part information and a logistical plan to receive the parts, provided some interesting challenges.

A multifunctional team consisting of Operations, Materials, and External Operation personnel was assembled to develop a plan to receive the parts, populate the computer systems with part sizing information while developing an annual forecast, load pricing information, and expand warehouse storage locations to accommodate these service parts. The team's biggest challenge occurred when it addressed a legal agreement regarding competitors' packaging on Bell dealership shelves. Because this legal agreement with some of Bell Truck dealers, it was decided to use all generic packaging. This did not seem to pose a problem since Bell Truck agreed to individually package service parts in generic packages before shipping them to PDC. However, early on in the project, unpackaged parts and inadequately packaged parts that did not meet John
Deere packaging standards started to appear. Since the decision had been made to use generic packaging, PDC could not use Deere logo packaging on Bell Truck service parts. In addition, PDC was not equipped to handle generic packaging. New cartons had to be designed, ordered, and delivered to the contract packager before the parts began to arrive. Yet the product had not been seen and no sizing information had been provided.

PDC made an educated guess about the number of additional carton types and sizes that would be needed for the project. Packaging specifications for new generic cartons were developed with a new part numbering system to identify them as generic packages. Orders for generic cartons were placed with Deere’s carton suppliers, but with a 4 to 6 week lead-time, another challenge arose. Deere had to store parts at their contract packagers while they waited for the generic cartons to be delivered. The next system challenge was how to identify and separate Bell Truck dealer orders so that Deere shipping containers would not be used for Bell dealerships. A systems change request was required to handle both the packaging routing changes and the system order-processing problem. Additional packaging issues arose, such as the lack of packaging consistency from one receipt to another and the inability of some of Bell suppliers to individually package service parts as Deere had requested. This meant that PDC had to quickly develop even more generic packaging.

As Deere struggled with delays in system change requests, the parts started to pile up at their contract packagers, resulting in congestion and delays processing Deere’s normal service parts through their contract packager facilities. With generic packaging material, Deere faced higher material prices because of shortened lead times and smaller order quantities. If PDC had been
consulted during the planning stages of this project, the department could have asked specific packaging questions and foreseen some of the problems. Delays in packaging material availability on the first day of the program release resulted in hundreds of backorders, which meant delays in providing the material to Deere’s customers.

**Case Study #2: Timberjack Acquisition in 2000**

In 2000, Deere’s Construction & Forestry Division (C&FD) purchased Timberjack, a forestry equipment manufacturer based in Sweden, to expand their market share in the forestry industry. Timberjack already had a global market share for forestry equipment, while Deere provided accessories for the forestry equipment. C&FD notified PDC nine months ahead of time that PDC would be packaging as well as distributing the service parts for the Timberjack service parts to both Deere and Timberjack dealers. PDC would be responsible for all packaging—approximately 26,000-service part numbers. This also proved to be a challenge, as Timberjack, Inc. packaged their service parts on the outbound side of the business and did not have any standard packaging guidelines for their service parts or any raw part dimensional data.

After a one-day trip to Timberjack warehouse, PDC was asked to develop generic packaging for service parts. Timberjack could not provide country source of origin, package quantity, annual forecast, or hazardous material (MSDS) information. As with the Bell Joint Venture project, PDC had to develop new cartons and place orders on various other packaging materials without enough information about the product that was to be packaged. In this case, it was the volume of inventory that was received which caused the most problems. PDC had packaging material
ordered, but it was not in the quantities that were needed. PDC was forced to rent warehouse space at its contract packagers to store bare parts while waiting for packaging material to arrive.

The shortage of packaging material caused backorders for Deere’s customers. Timberjack’s inability to supply the necessary annual part usage also inflated the packaging material cost because suppliers were forced to run special orders just to keep PDC supplied with packaging material. Deere’s Customer Service group fielded hundreds of calls from customers willing to take bare service parts just to keep a piece of equipment running.

Case Study # 3: Hitachi Mining Equipment Acquisition in 2002

Deere’s most recent venture between its C&FD Division and Deere-Hitachi was the distribution of Hitachi mining and construction equipment service parts in the Americas. This project was shared with PDC management in September 2001. PDC was told that it would absorb 38,000 service parts numbers. Originally, PDC was supposed to start to receive parts in December, but it did not receive any parts until early February. Throughout the entire project, PDC was told that Hitachi packaged 90% of their service parts and that PDC would just have to populate the part sizing information into its system and store the parts for worldwide distribution. Hitachi and a couple of specific supplier packages would be accepted into Deere’s system.

When PDC began to process the first service parts from Hitachi’s Houston's warehouse, they discovered not only inconsistent packaging, but also no packaging whatsoever. When PDC inquired into the inconsistency of the packaging, they were told that Hitachi’s warehouses in
Houston, Texas, and Vancouver, Canada actually packaged only 50% to 60% of Hitachi service parts. PDC would have to provide packaging for the remaining 40% to 50%.

Because of the lack of accurate communication, PDC again did not have sufficient generic packaging materials on hand. As the project progressed, PDC was told that the program would be released to the customers on May 1, 2001 and that 17,700 service parts would need to be processed by May 2, 2002. To accommodate Hitachi part identification requirements, outside programming service had to be hired to re-write software to allow PDC’s Zebra and PI-4000 printers the flexibility to print a new label format for Hitachi. Short lead times and small order quantities on packaging material mandated premium prices from suppliers so packaging costs increased. Because of the short lead-time, part proliferation was not done and PDC was told to bring in the Hitachi numbers and go back later and re-id or eliminate duplicate part numbers. Storage now had to build additional 9,000 locations to house duplicate parts, which created a large backlog in the storage of service parts. PDC did not physically have racks up to accommodate all the new Hitachi numbers, so they had to rent trailers to store parts until they could be unloaded and stored.

Summary

In all three case studies, if Deere units had involved PDC’s management in the project earlier, PDC could have been more pro-active in handling the packaging challenges. It is important to note that new acquisitions are not the only packaging challenge; new product releases also have similar impacts on PDC's packaging operations. If PDC does not know the size of part or what material it is made of, it is difficult to have enough of the correct packaging material on hand to
properly protect the new materials used in production. Up front planning would also reduce the cost associated with short lead-time deliveries and the premium paid for small production run of cartons.

**Deere Customer Satisfaction**

To validate the second assumption of this study, regarding customer satisfaction with Deere quality of service parts, the assumption must be viewed from two perspectives: the end user and the factory customer.

Why does customer satisfaction need to measured in the first place? There seems to be is a widespread appreciation of the importance of satisfying customers and a wide range of justifications for managing customer satisfaction. Terry G. Vavra (2002) categorizes these reasons into three groups: "1) Philosophical or core values: It's good business to aim to provide satisfaction to your customers. 2) Economic: Satisfied customers exhibit longer and higher lifetime value because they serve as advocates in winning over new customers. It is also cheaper to keep customers satisfied than to replace them. 3) Certification: The revised standard requires assessment of customer satisfaction as a consequence of improvement."

**End User Satisfaction**

With Deere's tradition of having lifelong customers, the company needed to determine how its end customers perceived John Deere service parts quality. It was decided that the best way to determine customer satisfaction was to ask the customers. The Distribution Reliability Department was asked to champion this undertaking. The first step was to form a committee to
address end user satisfaction, understand the main concerns of top management, and develop a method to gather the information, tabulate it, and analyze the results. During the first committee meeting it was decided that the fastest way to contact numerous dealers for feedback was to distribute a survey at the annual Parts Expo. The committee designed the dealer survey, which was distributed to 4551 dealers during Parts Expo. The major purpose of the survey was to solicit input from Deere dealers regarding several aspects of customer satisfaction related to the packaging and distribution of service parts. The survey was designed to be short and concise, isolate the clearly stated customer opinions, and allow management to build their strategies accordingly. Each of the six questions was meant to address possible problem areas in PDC's packaging and distribution processes. Below is a sample of the survey.

![Sample Dealer Survey](image)

*Figure 2. Sample Dealer Survey*
Of the 4551 attendees, 1281 dealers completed the survey—a 28% response rate. PDC staff collected, tabulated, and summarized the survey data. The survey data provided insight into two of Deere's distribution channels by isolating just two order types: Machine Down (emergency) Orders and Stock Orders. These order types were chosen to reflect the extreme conditions a service part would encounter on the way to the end-user. Machine Down orders are picked, packed, and shipped by one person and normally transported by one carrier all the way to the end user. Stock orders are also picked, packaged, and shipped by one person, but this is where the similarity ends. With Stock orders, the parts are loaded directly onto a trailer, taken to a cross-docker, consolidated with whole goods shipments, and sent to regional depots. There the parts are de-consolidated into smaller bundles and shipped via another carrier to the end user.

The summary survey results provided in Tables 4 and 5 reflected the attendees' top concerns. Sixteen percent of the responses were related to the carrier, and not necessarily the packaging. The condition of sheet metal, which might be related to packaging, was ranked seventh on customer concerns. General packaging problems was ranked tenth in customer concerns with 4% of the responses.
Table 4. Results of Survey for Machine Down Orders

### Distribution Reliability Questionnaire

#### Machine Down Performance

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Satisfactory</th>
<th>Noticed</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Part</td>
<td>83%</td>
<td>15%</td>
<td>1%</td>
</tr>
<tr>
<td>Right Quantity</td>
<td>84%</td>
<td>15%</td>
<td>1%</td>
</tr>
<tr>
<td>On Time Delivery</td>
<td>80%</td>
<td>17%</td>
<td>3%</td>
</tr>
<tr>
<td>Condition of Parts</td>
<td>70%</td>
<td>26%</td>
<td>3%</td>
</tr>
<tr>
<td>Internal Packing</td>
<td>76%</td>
<td>19%</td>
<td>3%</td>
</tr>
<tr>
<td>Parts Availability</td>
<td>81%</td>
<td>15%</td>
<td>3%</td>
</tr>
<tr>
<td>Overall Service</td>
<td>79%</td>
<td>18%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Table 5. Results of Survey for Stock Orders

### Distribution Reliability Questionnaire

#### Stock Order Performance

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Satisfactory</th>
<th>Noticed</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Part</td>
<td>82%</td>
<td>14%</td>
<td>2%</td>
</tr>
<tr>
<td>Right Quantity</td>
<td>82%</td>
<td>15%</td>
<td>1%</td>
</tr>
<tr>
<td>On Time Delivery</td>
<td>74%</td>
<td>18%</td>
<td>6%</td>
</tr>
<tr>
<td>Condition of Parts</td>
<td>70%</td>
<td>24%</td>
<td>4%</td>
</tr>
<tr>
<td>Internal Packing</td>
<td>68%</td>
<td>24%</td>
<td>6%</td>
</tr>
<tr>
<td>Parts Availability</td>
<td>80%</td>
<td>15%</td>
<td>4%</td>
</tr>
<tr>
<td>Overall Service</td>
<td>76%</td>
<td>18%</td>
<td>4%</td>
</tr>
</tbody>
</table>
The survey revealed that the majority of John Deere end users were satisfied with the quality of service part distribution, but that there were some concerns about the packaging of specific family of parts such as glass. Overall, the survey indicated that Deere customers were satisfied with John Deere parts service 76% – 79% of the time, depending on the order type.

**Factory User Satisfaction**

To validate the satisfaction of the second user type, factories, proved more difficult. Each Deere division has its own idea as to what is acceptable service. Cycle time was chosen as the standard used to judge PDC on factory satisfaction. Some cycle time reports help keep a handle on the movement of material into PDC’s contract packaging facilities, while other cycle time reports monitor the flow of material all the way to the shelf for customer availability.

In two years, PDC improved overall cycle time from 6.8 days to 4.7 days. The fast turnaround of material from factories/suppliers allowed PDC to reduce safety stock and shorten lead-times on orders to the factories and improve inventory turns. PDC’s overall FY2001 cycle time from ship to store is shown in Table 6 below, which was taken from the PDC's Director year-end report.
Table 6: *PDC Cycle Time FY2001*

<table>
<thead>
<tr>
<th>Fiscal Month</th>
<th>Receipt from 3P</th>
<th>Receipt from Factory/Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov.</td>
<td>33.09</td>
<td>8.20</td>
</tr>
<tr>
<td>Dec.</td>
<td>42.20</td>
<td>10.62</td>
</tr>
<tr>
<td>Jan.</td>
<td>57.98</td>
<td>12.07</td>
</tr>
<tr>
<td>Feb.</td>
<td>39.30</td>
<td>9.39</td>
</tr>
<tr>
<td>Mar.</td>
<td>39.05</td>
<td>10.22</td>
</tr>
<tr>
<td>Apr.</td>
<td>39.49</td>
<td>11.29</td>
</tr>
<tr>
<td>May</td>
<td>36.44</td>
<td>10.48</td>
</tr>
<tr>
<td>Jun.</td>
<td>51.41</td>
<td>11.40</td>
</tr>
<tr>
<td>Jul.</td>
<td>47.91</td>
<td>14.73</td>
</tr>
<tr>
<td>Aug.</td>
<td>39.02</td>
<td>14.79</td>
</tr>
<tr>
<td>Sep.</td>
<td>26.92</td>
<td>8.83</td>
</tr>
<tr>
<td>Oct</td>
<td>21.48</td>
<td>7.80</td>
</tr>
<tr>
<td><strong>Total Average Hours</strong></td>
<td><strong>39.52</strong></td>
<td><strong>10.80</strong></td>
</tr>
</tbody>
</table>

This historical cycle time data is tracked on a weekly, monthly, and yearly basis to help PDC reduce cycle time and to demonstrate the commitment to providing better, faster service to the factory user without having to increase inventory.

**Summary**

Deere needs to continually build customer loyalty by providing their customer with the best experience with service part packaging and timely delivery. It is cheaper to keep a customer satisfied than to replace a customer. One bad experience with a company not only loses the one sale, but also, through word-of-mouth, might eliminate future potential sales.
Conclusion

As stated in the *Principles of Package Development* (Griffin, Sacharow, and Brody, 1985), "Successful performance of the packaging function depends first on recognizing that the results must serve marketing and distribution purposes." As Deere adds new products and acquires new businesses, packaging must also evolve to better protect the product all the way through the supply management line to the end user. However, in order to develop a package that will protect the product, the John Deere Parts Distribution Center needs to work with the manufacturers to acquire information about a part before the product arrives at the receiving dock. The habit of reacting to new product packaging requirements after the product is shipped to the PDC needs to be stopped by addressing packaging needs with the design engineers at the Deere facilities.

John Deere PDC is like many other businesses in that packaging is one of its highest operational costs next to the picking and transportation costs for distributing service parts to its customers. However, in order to address these cost issues and develop an effective package, some key information regarding a product must be known. Dimensions, weight, material, county source of origin, storage type, distribution concerns, and marketing all help determine packaging requirements. In order to properly protect machine surfaces, electrical components, and cosmetic surfaces, as well as to meet cleanliness specifications, the packaging coordinator needs to be aware of the product make-up as soon as possible. For example, if a part has to be produced in a clean environment, it should also be packaged in a clean environment. This might lead to a decision to package at point-of-manufacturing. Factory units need to consider service part packaging at the same time that they are adopting the part. They need to determine whether a
product needs to be individually packaged at the point-of-manufacturing or whether it can be safely transported to a centralized packaging center.

Packaging is also a very important part of Deere’s customer support system. If the service parts arrive on time but are damaged and not salable, Deere has failed their customer. Deere needs to become more proactive in developing service part packaging to reduce product delivery delays to their customers because product delays can lead to customer dissatisfaction and possibly loss of sales. In order to comply with customer expectations, Deere needs to look at packaging earlier in the part adoption and manufacturing process. Packaging these critical types of parts is key to the quality of service parts and the customer's satisfaction.

As its customer base expands, Deere needs to continue to improve customer satisfaction by making each encounter with the Deere organization a remarkable experience. There are companies that take the simple idea that price and delivery will keep customers. However, the ramifications of ignoring packaging issues are dangerous to the health of the organization, not only in terms of money, but also in product quality, customer satisfaction, and environmental responsibility.
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Appendix A: Example Warranty Claim

Year to Date by Claim Type

- Battery: $0
- CPP: $13,000,000 (13%)
- Parts (Def): $6,000,000 (6%)
- Parts (90 Day): $36,000,000 (36%)
- PIP: $120,000,000 (27%)
- Special Allow: $140,000,000 (29%)
- Warranty: $100,000,000 (-8%)

Change:
- Battery: 0%
- CPP: 0%
- Parts (Def): 6%
- Parts (90 Day): 36%
- PIP: 36%
- Special Allow: -8%
- Warranty: -8%

Legend:
- Fiscal 2001
- Fiscal 2000
- Change

Fiscal 2001 vs Fiscal 2000: Change ranges from -100% to 200%.