

# Developing and Implementing Standard Logistics Solutions for Eastman Kodak Company's Inbound Supply Chain

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In Partial Fulfillment of the Requirements for the Degrees of

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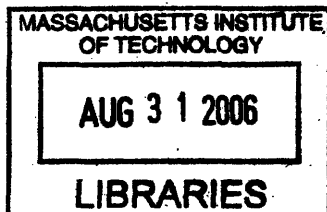
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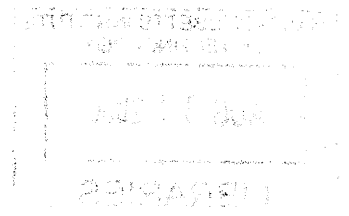
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## **Abstract**

Eastman Kodak Company managed its supply chain operations at a regional level until 2002 when it created the Global Logistics group. Prior to this, there had not been much corporate focus on the inbound supply chain; in addition, Kodak lacked a standard process for the definition, selection, and implementation of inbound logistics solutions. As a result, inventory optimization occurred at a local level without insight into what was best for the corporation as a whole. This led to situations where material inventories were not managed effectively, implementations of inbound logistics methods varied widely across the corporation, and suboptimal inbound logistics solutions were created or selected. Ultimately these practices led to inefficient supply chain management and excessive inventory and operating costs for Kodak. The purpose of this thesis is to develop a set of standardized inbound logistics solutions for the company, create a decision tool that can be used to aid in the selection of the most appropriate solution, and implement this standard process across the corporation.

This thesis is the result of work done during a 6.5 month LFM internship at Eastman Kodak Company in Rochester, New York.

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# CHAPTER 1 INTRODUCTION AND OVERVIEW

With the emergence of the global economy during the latter part of the 20<sup>th</sup> Century, U.S. companies have benefited from demand in emerging markets, but they are also challenged by such issues as transportation lead times, international taxes and tariffs, and lower labor and material costs in foreign countries. Under the circumstances of this competitive landscape, companies are constantly pressured to produce and transport goods at a lower cost and with shorter cycle times. In some cases, this means sourcing materials from foreign countries where labor and material costs are the lowest. Manufacturing may take place anywhere in the world to take advantage of the lowest overall cost of labor, capital, and taxes. Finally, the global economy dictates that a finished good may be demanded any place in the world.

In order to manage this complex supply chain, maintain excellent customer service levels, and contend with growing global competition, effectively managing logistics operations has become increasingly important to businesses around the world. In some cases, lean logistics operations may be the main competitive advantage for a company. Many different logistics models, services, and companies have developed over time to address this need, and choosing the most effective and economical logistics strategy can prove to be quite a challenge. A suboptimal logistics strategy will lead to inefficient material and product flow and generate unnecessary operating and inventory costs. At Eastman Kodak Company, selecting the best logistics strategy is further complicated by the company's broad portfolio of products and geographic locations that, when combined, create a very complex supply chain.

## 1.1 EASTMAN KODAK COMPANY

Eastman Kodak Company's vision is to be the world leader in imaging. This journey dates back to 1880 when George Eastman started to commercially manufacture the first gelatin dry plates for photographers.<sup>1</sup> Soon afterwards, Eastman Kodak Company was founded and for nearly a century has thrived from the development and manufacturing of traditional cameras, film, paper, and X-ray products. The traditional film business has been especially profitable for Kodak, demanding a premium price for the name brand and yielding hefty gross margins around 30%;<sup>2</sup> in fact, the primary reason for Kodak's camera production was to generate demand for its high-margin film products.<sup>3</sup>

Eastman Kodak Company's undisputed success lasted for most of the 20<sup>th</sup> Century until the Japanese company, Fuji Film, challenged Kodak's position in the film market. In the 1980s, Japan had an import tariff in place on foreign film, and Fuji beat Kodak to market with high-resolution color film and disposable cameras.<sup>4</sup> This permeation into Kodak's cash cow only signaled the beginning of the changes that would occur in the imaging industry. In the 1990s, digital products took hold, and the market has not looked back since. The popularity of digital

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<sup>1</sup> Source: Kodak website,

<<http://www.kodak.com/global/en/corp/historyOfKodak/buildingTheFoundation.jhtml?pq-path=2217/2687/2690>>.

<sup>2</sup> Source: Schoenberger, Chana. "Can Kodak Make Up for Lost Moments?." *Forbes*. October 6, 2003.

<sup>3</sup> Source: Palmer, John. "Level Loading and Cross Docking in a Global Logistics Network."

<sup>4</sup> Source: Fletcher, Matthew. "Film Fight: Fuji vs. Kodak." *Asiaweek*. July 5, 1996.

cameras has drastically eroded film sales, and digital file sharing has reduced the number of hardcopy prints that are produced. Furthermore, while the sales of digital cameras themselves are skyrocketing, the marginal yield on a digital camera is razor-thin.

## 1.2 CURRENT STATE

Due to the competitive and dynamic digital imaging industry, Kodak is under extreme pressure to reduce material and labor costs and improve operating efficiencies in order to remain a viable entity. According to its 2004 Annual Report, “We are reducing costs, facilities, and functions worldwide to change our overall business model for the competitive digital world. We’re preparing ourselves to be faster to market with products and total systems solutions.”<sup>5</sup> One way that Eastman Kodak Company is striving to remain competitive and reduce costs is through inventory reduction activities. Holding inventory ties up physical space in warehouses and production areas, and it financially ties up cash that could be used to fund other activities. Also, in the ever-increasing digital age, excess inventory increases the chance of a product becoming obsolete before it reaches the customer.

One way in which Kodak is reducing inventories is through the use of consignment contracts. Consignment allows Kodak to hold materials at its locations and delay payment for the goods until they are used or sold. Part of the reason for this strategy is to reduce the financial effects of inventory, essentially creating zero days of inventory for Kodak. In practice, consignment does not eliminate the physical inventory, but does push the cost of carrying inventory back onto the supplier. In addition, while the direction to implement consignment is a corporate one, it is applied differently in various facets across the company. This phenomenon is due in part to Kodak’s organizational history.

Eastman Kodak Company’s organizational structure is composed of product-focused business units and corporate common resources. Currently, Kodak’s four business units include Digital & Film Imaging Systems, Health Group, Graphic Communications, and Display & Components. These groups share business resources from corporate functions such as Finance, Marketing, Research & Development, and Global Manufacturing & Logistics (GM&L). GM&L is the largest shared function among the business groups; it includes manufacturing capital, equipment, and knowledge, as well as transportation solutions and resources.

Global Logistics resides within GM&L and is relatively new to the organization; previously, logistics functions were handled by Kodak’s four major business units at a regional level. This practice prevented synergies from developing that would allow for more efficient and cost-effective logistics solutions for the corporation as a whole. Logistics solutions were adopted and implemented as one-off solutions, and they were focused upon optimizing logistics at a local level. The Global Logistics organization was initiated in 2003 to consolidate and streamline logistics operations and improve supply chain efficiency in what became known as the Supply Chain Excellence initiative. The journey to improve Kodak’s inbound logistics began in 2003 but was still in its early stages at the onset of this thesis work.

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<sup>5</sup> Source: Kodak website, <<http://www.kodak.com/US/en/corp/annualReport04/?CID=go&idhbx=annualreport>>.

### **1.3 PROBLEM STATEMENT**

Eastman Kodak Company lacks a standardized process for the definition, selection, and implementation of logistics solutions in its inbound supply chain. As a result, people are not aware of all of the existing logistics options and the associated benefits, and inventory optimization occurs at a local level without insight into what is best for the site, business unit, or corporation as a whole. This leads to a situation where material inventories are not managed effectively, implementations of one logistics method will vary widely across the corporation, or suboptimal logistics solutions are created or selected. In the end, all of these situations lead to inefficient supply chain management and excessive inventory and operating costs for Kodak.

### **1.4 PURPOSE AND DELIVERABLES**

The purpose of this thesis is to investigate and understand the current state of Kodak's inbound supply chain, determine inbound logistics best practices, and provide recommendations for Kodak to standardize and improve its inbound logistics operations. The expected deliverables include a standard method for inbound logistics decision-making, a defined set of recommended logistics solutions endorsed by the company, standard work that defines these solutions, and a validation process or trial implementation of the decision tool and standard logistics solutions. In addition, the results of this thesis work will be summarized, and conclusions and recommendations will be presented.

### **1.5 THESIS OUTLINE**

This thesis is organized into eight chapters.

*Chapter 2* provides an overview of logistics and supply chain concepts, lean theory as it is applied to logistics, and transportation terminology.

*Chapter 3* gives an overview of Kodak's inbound logistics, including the stakeholders, the reason for focusing on inbound logistics, and ongoing projects related to inbound logistics that were concurrent with this thesis.

*Chapter 4* investigates Kodak's current state of inbound logistics solutions, analyzes, classifies and defines these solutions, and specifies the solutions endorsed by the corporation.

*Chapter 5* introduces the decision tool, including the decision tree and supplemental materials, decision criteria and data, and financial models.

*Chapter 6* describes the process of validating the decision tool, analyzes the data gathered, and highlights the lessons learned during this process.

*Chapter 7* describes the decision tool implementation strategy including the steps and resources that are envisioned for a successful implementation.

*Chapter 8* summarizes the conclusions and benefits that resulted from this research project.

# CHAPTER 2 SUPPLY CHAIN AND LEAN LOGISTICS

A brief introduction to logistics and transportation, supply chain, and lean terminology and concepts is critical for those not well versed in these subjects. This overview will enhance the understanding of this thesis work, including the initial challenges that existed, the concepts upon which decisions and conclusions were based, and a general context for the results and impact that this thesis work will have for Eastman Kodak Company.

## 2.1 LOGISTICS

According to Baudin, “Logistics is comprised of all of the operations needed to deliver goods and services, except making the goods or performing the services.”<sup>6</sup> One important aspect of this definition is that logistics does not involve any conversion or processing of goods; these functions fall under the category of production. Although production is a key factor in logistics strategy, it is outside the scope of this thesis.

While logistics may typically bring to mind the flow of physical goods, it also includes the parallel flows of information and finances. Material flows are defined as the activities that go into shipping, transporting, receiving, and storing goods between and within plants. Information flows include all of the transactions that are necessary to support material flows, forecasting, planning, and historical data analysis. Financial flows depict the exchange of payments based upon triggers from the material and information flows.<sup>6</sup> Figure 1 maps out the three flows of information, material, and finances for one of Kodak’s inbound raw chemicals. Note the complex flow of information and finances relative to the actual material flow.

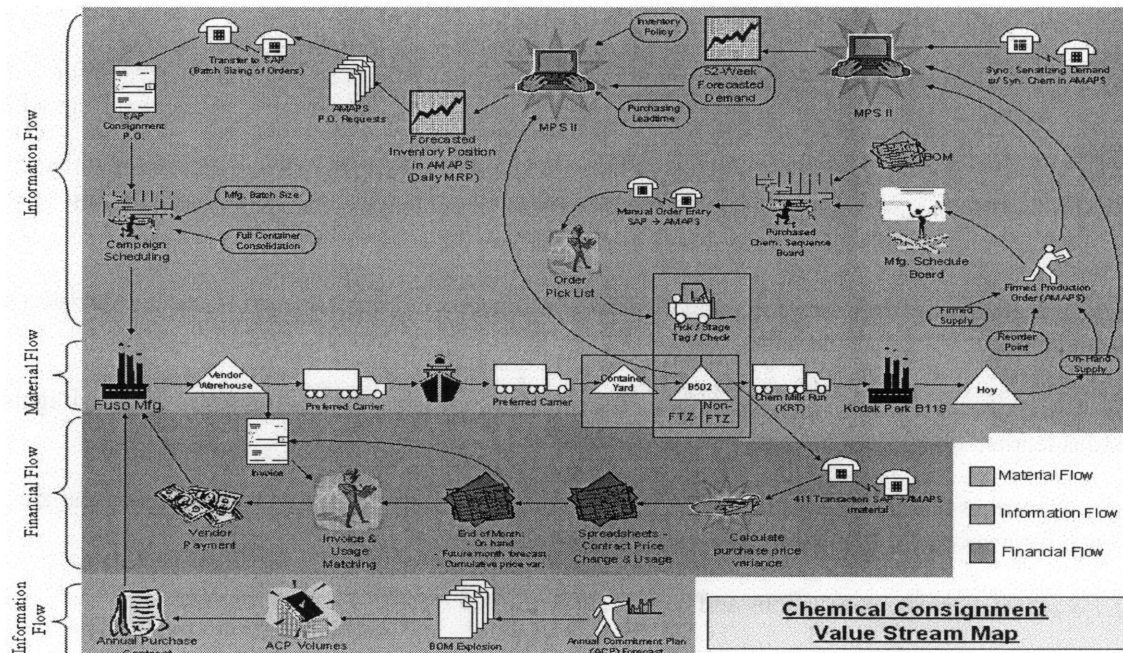


Figure 1. Value stream map for an inbound raw material at Kodak.

<sup>6</sup> Source: Baudin, Michael. *Lean Logistics: The Nuts and Bolts of Delivering Materials and Goods*.

These flows can span from Kodak's suppliers all the way through to the customers and, as a result, the management of logistics is broken down into three segments: inbound, in-plant, and outbound. At Kodak these segments are referred to as supplier-to-Kodak, Kodak-to-Kodak, and Kodak-to-customer, respectively. Internal or Kodak-to-Kodak logistics varies from inbound and outbound logistics in that control of the system resides with one party and the structure and methods used may be more tailored to the capacity, size, or material demands of the facility or site. Inbound and outbound logistics involve many different stakeholders that require greater coordination, tracking, and control. In addition other factors such as customs clearance, financial transactions, and greater transportation distances may come into play more so in these segments than in internal company logistics. The focus of this thesis work will be on inbound, or supplier-to-Kodak, logistics.

## **2.2 SUPPLY CHAIN**

Logistics describes the flow of material, information, and finances through the supply chain from Kodak's suppliers all the way through to its customers. While logistics describes how these items flow, the supply chain is the structure or entities through which these items flow. "A supply chain is a coordinated system of entities, activities, information and resources involved in moving a product or service from supplier to customer."<sup>7</sup> The parties that may be involved in a supply chain include manufacturers, distributors, retailers, and transportation providers. Notice that a supply chain includes both production and logistics activities, but ultimately the concern of this thesis work is with the logistics activities and stakeholders in the supply chain.

The traditional scope of a supply chain has been very limited, sometimes focusing just on the outbound piece that serves the customer. Business managers have been ingrained with a customer focus, and often the supplier's needs or concerns are not taken into account except for what is required to obtain the necessary resources.<sup>8</sup> The scope of recent supply chain management theories and practices has expanded, and an end-to-end supply chain concept has developed that extends from the customer's customer upstream to the supplier's supplier.<sup>9</sup> For Kodak this means not just focusing on its immediate suppliers, but also on suppliers that are a tier below, and not focusing just on a customer, such as Wal-Mart, but also focusing on the end customer who will ultimately be selecting, purchasing, and using Kodak products. This broader supply chain scope adds complexity and makes coordination a more cumbersome and important task.

## **2.3 LEAN LOGISTICS**

One of the ways to help in the coordination of a broad and complex supply chain is to develop strong, collaborative relationships with other partners in the supply chain. While this concept stems from the Toyota Production System's lean manufacturing practices, it also has applications in lean logistics. Lean logistics is the logistics equivalent to lean manufacturing with two main objectives:<sup>8</sup>

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<sup>7</sup> Source: Wikipedia Dictionary. "Supply Chain" definition.

<sup>8</sup> Source: Baudin, Michael. Lean Logistics: The Nuts and Bolts of Delivering Materials and Goods.

<sup>9</sup> Source: Wikipedia Dictionary. "Supply Chain Management" definition.

1. Delivery of the materials needed, when needed, in the exact quantity needed, and conveniently presented, to production for inbound logistics and to customers for outbound logistics.
2. Without degrading delivery, pursue the elimination of waste in the logistics process.

There are a series of lean concepts and strategies that stem from the Toyota Production System (TPS) and are targeted to help achieve these two objectives. Kodak and the Global Logistics Strategy team have embraced the lean principles of TPS to improve supply chain performance through the Kodak Operating System (KOS), Kodak’s version of the Toyota Production System.

## 2.4 KODAK OPERATING SYSTEM (KOS)

Like TPS, KOS consists of a set of dependent, mutually reinforcing principles, operating procedures, and culture. Given that the meaning and inter-relation of these concepts can be difficult to conceptualize, and to emphasize that TPS is a *system* of operation, it is depicted as a house.<sup>10</sup>

### 2.4.1 Toyota Production System House

The Toyota Production System House consists of four major components: the roof, which represents the desired goal; two pillars, which are the supporting resources or structure required to reach that goal; a foundation, which represents the system stability that must be developed from the start; and the content of the house, which is the culture that supports and embraces these other three components. The TPS house is applied to lean logistics by Cook et al. in “A Lean Approach to Cross-Docking” and is depicted in Figure 2.

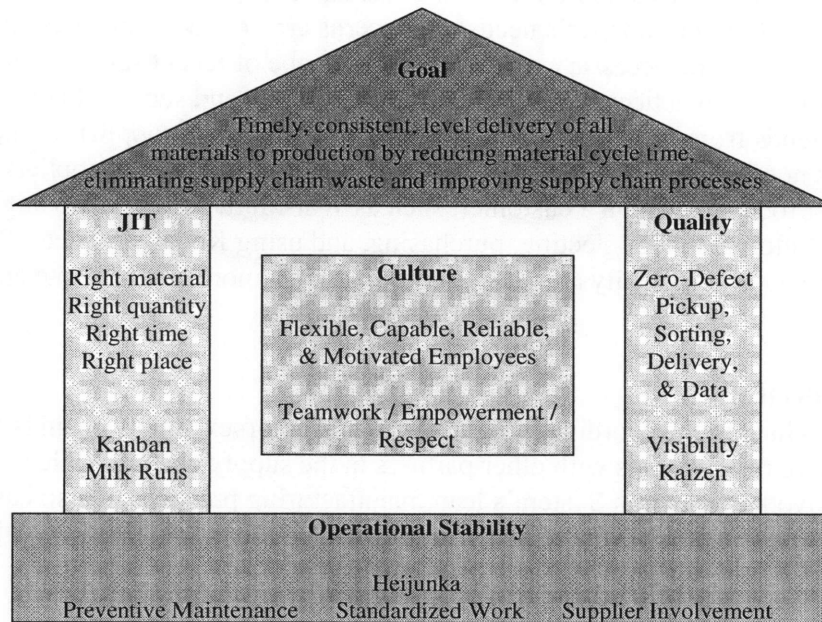


Figure 2. The Toyota house applied to supply chain.<sup>10</sup>

<sup>10</sup> Source: Cook et al. “A Lean Approach to Cross Docking.”



Although it is referred to as the TPS house, due to the similarities between TPS and KOS, the house is also an accurate representation of the lean concepts embodied by the Kodak Operating System. The goal of the house is essentially the same as the two objectives of lean logistics presented in section 2.3. The pillars of the house, in this case, are just-in-time and quality. The foundation represents the operational stability that must be achieved and the culture resides mainly in the employees, their attitudes, and their work ethics.<sup>10</sup> The main focus of this thesis is to achieve operational stability in Kodak's inbound supply chain, particularly through the standardization piece of the supply chain house foundation. While the focus will be on standardization, supplier involvement, just-in-time concepts related to pull and production leveling, and visibility will also play a peripheral role.

#### **2.4.2 Waste**

One concept that lean logistics and the supply chain house have in common is waste. According to KOS principles, waste is "any activity or action performed that does not add real value to a product or service by changing its form, fit, or function."<sup>11</sup> This is an interesting concept to consider in light of the earlier definition given for logistics. Logistics does not involve any processing or transformation activities, only the flow of materials, information, and finances. This definition of waste therefore suggests that everything related to logistics is waste! To explore this further, we can look at a summarized description of waste: any activity the customer is not willing to pay for.<sup>11</sup> Again, this definition of waste relates to logistics activities when we consider that Kodak's digital camera consumers do not care about how that camera got to the retailer, how Kodak signaled to the OEM to make more cameras, or how Kodak paid its suppliers for the raw materials used to make the camera.

In order to identify waste so it can be eliminated, seven classifications of waste have been defined: transportation, inventory, motion, waiting, inventory, overproduction, overprocessing, and defects.<sup>11</sup> Most of these can be traced directly to logistics activities in the supply chain further illustrating the point that logistics activities, in general, are wasteful activities. Following are some examples of these types of waste as they apply to logistics activities:

*Transportation* requires little explanation because it represents the flow of material, one of the three aspects of logistics.

*Inventory* is created in many logistics activities some of which include warehousing or shipping full truckloads of goods when only a small amount is needed. Inventory, or the desire to get rid of it, can contribute to the additional waste in the form of excess transportation, motion, overprocessing, and defects.

*Motion* is an excessive form of waste that may be seen in shipping if the goods are not loaded in sequential order for delivery thus requiring pallets to be removed from and placed back on the truck to allow for access to other goods.

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<sup>11</sup> Source: Eastman Kodak Company. "The Seven Wastes," Revision 1.0.

*Waiting* at docks to pick up and deliver materials is a common occurrence because all of the dock bays may be full at busy times of the day.

*Overproduction* creates additional logistics waste in the form of excess inventory and material movement to store and retrieve these inventories.

*Overprocessing* seems like a waste resulting from production, however, this can also occur in logistics with consignment, for example, when additional work is required to update the status of consignment goods and reconcile inventories at the end of the month.

*Defects*, sometimes referred to as “corrections” are generated if inbound goods are not packaged following Kodak’s requirements thus requiring repackaging or relabeling or leading to damaged goods.

### **2.4.3 Just-in-Time**

The two pillars of the supply chain house are quality and just-in-time. Quality is a crucial part of developing a lean supply chain and obviously crucial to Kodak’s customers. Given that the focus of this thesis work is on the inbound supply chain, the assumption is that incoming goods and transportation of these goods meet Kodak’s standards; therefore, concepts and lean tools related to quality will not be elaborated. Just-in-time or JIT is defined as “delivery of the right material in the right quantity at the right time to the right place.”<sup>12</sup>

One facet of just-in-time operations is that it forces waste, in the form of inventory, to occur where it is caused. For example, since JIT material should not flow downstream until it is needed or pulled, if a supplier is overproducing, the material will pile up at the supplier. Similarly, if excess motion or processing is occurring at a point in the supply chain, this will create a bottleneck in the logistics or production process and create a pile of inventory before the problematic point. Thus, JIT is an important contributor to visibility in a lean supply chain, and it helps to highlight the true causes of waste so they can be eliminated. The tools that are used in conjunction with JIT to reduce waste and create a lean supply chain include heijunka, takt, continuous flow, and pull. These concepts are described in the next subsection.

### **2.4.4 Operational Stability and Heijunka**

The first step to implementing a lean supply chain is to create stability. According to Earl Chapman, KOS expert, stability allows for “real problems, not special causes” to be addressed and resolved; in other words, lean implementation should not be about firefighting. In addition, a supply chain that is not stable creates a moving target for improvement so that it becomes difficult to determine the current state, the desired future state, and the gap that exists between the two. In other words, stability is necessary to implement standard work that will ultimately allow for the efficiency gains that are desired.<sup>13</sup>

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<sup>12</sup> Source: Cook et al. “A Lean Approach to Cross Docking.”

<sup>13</sup> Source: Eastman Kodak Company. “Production Control System.”

Heijunka is production leveling. It aims to create stability in the supply chain, and as a result, it makes up the foundation of the supply chain house. The purpose of heijunka is to dampen customer demand variations so that level, consistent factory production schedules can be adhered to.<sup>14</sup> Heijunka involves leveling both the type and quantity of output or production over a fixed period of time. This allows for better utilization of production and logistics resources by allowing both Kodak and its suppliers to plan ahead and set production and delivery schedules. In order to do this, a finished goods inventory buffer must be created to satisfy the customer's demand and to concurrently maintain level production.

Although this buffer stock generates waste in the supply chain, it insulates the downstream portion of the supply chain from customer demand variations and prevents the amplification of waste. This phenomenon, where variations become magnified as they are passed down through the supply chain, is known as the bullwhip effect.<sup>15</sup> Figure 3 illustrates this concept. If not controlled, erratic production schedules will lead to inconsistent, lumpy material orders that translate into large, unscheduled or expensive, expedited material deliveries. In turn, the supplier may be implementing wildly erratic production schedules, trying to fill rush orders, or holding large piles of finished goods inventory to insulate itself from these magnified supply chain variations.

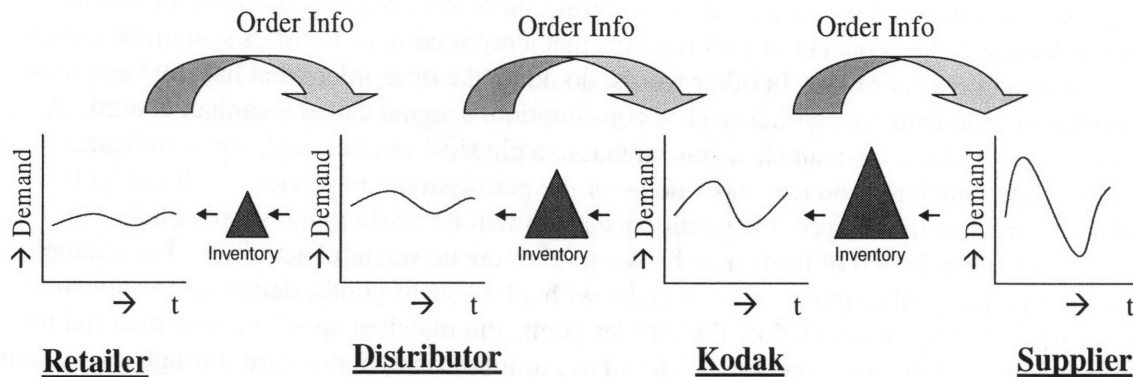


Figure 3. The bullwhip effect in a supply chain.

There are three requirements for heijunka: 1. a commitment to level operations from senior management, 2. a manufacturing process with built-in continuous flow at takt, and 3. factory production based upon pull, not on capacity levels or forecasts.<sup>14</sup> The first tenet refers to the fourth aspect of the supply chain house, which is the culture and people that are inherently part of the supply chain. This can be a driving force or a cause for failure in implementing lean. The remaining requisites for creating a level supply chain are continuous flow, takt, and pull; these concepts will be explained in the next subsection. In the context of these discussions, it is important to understand that it is not feasible to create a 100% completely level supply chain; to do so would be financially prohibitive, and thus, tradeoffs are required.

<sup>14</sup> Source: Eastman Kodak Company. "Production Control System."

<sup>15</sup> Source: Baudin, Michael. Lean Logistics: The Nuts and Bolts of Delivering Materials and Goods.

#### **2.4.5 Flow, Takt, and Pull**

Continuous flow is defined as the production and movement of one item at a time through a series of processing steps, as continuously as possible, with each step making just what is required by the next step.<sup>16</sup> The implications for logistics are that if production is operating in a continuous flow manner, it requires the coordinated continuous delivery of one item at a time, otherwise waste will exist in the system. The most visible form of waste is inventory piled at the dock, sitting before the first process step, or located in a warehouse location. Other peripheral wastes include the excess motion to rotate stock, transportation to store material and then retrieve it, or losses due to damage or obsolescence. It is important to note here that moving items one at a time through the supply chain may not be cost effective. Therefore, true continuous flow is often not the goal but, rather, some optimal scenario involving production and logistics that minimizes the total delivered cost.

Continuous flow does not just happen at will or at a random rate; there is a timing associated with this continuous flow. This timing is referred to as takt and can be thought of as the heartbeat of the lean supply chain. Takt is the rate of customer demand, or the speed at which one unit of output must flow through the system in order to meet customer demand. Similar to continuous flow, misalignment of takt will generate waste in the supply chain.

Finally, customer demand is mentioned in the definition of takt, but how does one determine customer demand? The concept of pull requires that a production or logistics system be driven by consumption or withdrawal. In other words, do not make or reorder what has not been used. In order to communicate this withdrawal or consumption, a signal called a kanban is used. A kanban can be anything from an electronic signal to a physical reorder card, and it indicates what to produce, how much to produce, and when—or the permission—to produce.<sup>17</sup> If this pull signal is incorrect or not obeyed, the result once again will be waste in the supply chain. In addition, the kanban in and of itself may be wasteful or create wasteful activities. For example, a kanban card is moved through the supply chain with a lot size of goods, delivered to a location for ordering when the lot falls below the reorder point, and matched up with a new material lot when an incoming delivery is received. The steps required to move this card through the system are an example of waste. Furthermore, additional activities are required to track down lost or misplaced kanban cards, create new cards, and monitor the number of cards in the system. Short of using telepathy to signal for replenishment, it is difficult to create a kanban system that is devoid of waste.

If, in a perfect world, Kodak were able to implement continuous flow at takt with pull, it would be able to operate with no inventory. Obviously, we are not in a perfect world. Machines break down, material deliveries are delayed by inclement weather, and, for some processes and products, continuous flow is inordinately expensive. Furthermore, even if inventory could be eliminated, other sources of waste, such as kanban signals and the necessity to move materials between customers and manufacturing locations, will never cease to exist. With this realization,

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<sup>16</sup> Source: Eastman Kodak Company. "Production Control System."

<sup>17</sup> Source: Eastman Kodak Company. "Kanban/Pull," Version 1.0.

the need for relentless continuous improvement becomes apparent, and as a result, it is a significant tenet of lean theory.

## 2.5 TRANSPORTATION AND LOGISTICS TERMINOLOGY

To provide a basis of understanding for the rest of the thesis, some transportation and logistics terminology will be defined based upon industry standards. Specific qualifiers and applications of this terminology as it relates to Eastman Kodak Company's logistics operations will be further detailed in Chapter 4.

**Container** – A standard-sized, rectangular metal box that can be used to transport freight by ship, truck, and rail. Containers are designed to fit in ships' holds<sup>18</sup> and are often referred to as ocean containers;<sup>19</sup> however, they can also be transported on public roads atop a container chassis towed by a truck.<sup>18</sup> The latter scenario occurs when ocean transport is combined with truck and/or rail transport, also known as intermodal transportation.<sup>19</sup> Figure 4 depicts an intermodal transportation scenario in which a container is being off loaded from a railcar and loaded onto a chassis for transportation by truck.

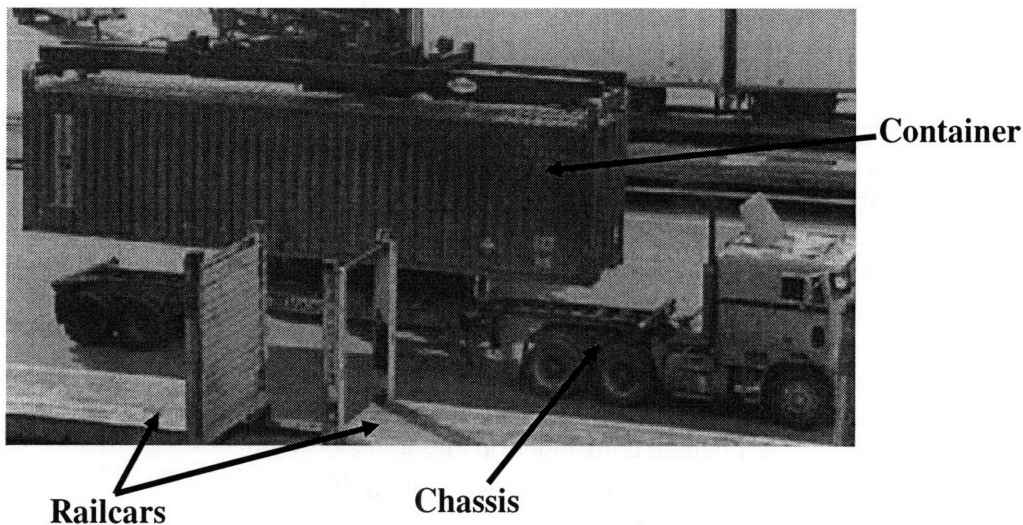


Figure 4. Picture of a container off loaded from a railcar for intermodal transportation.<sup>20</sup>

**Trailer** – A trailer, often referred to as a semi-trailer or tractor trailer, is an enclosed container or flat chassis that is used for freight transportation via land.<sup>19</sup> It is similar to a container in size and purpose; however, the chassis and wheels are part of the trailer.<sup>21</sup> Trailers can also be used for storage and, in the interest of time, often a tractor will drop off an empty trailer in exchange for a full one (and vice versa) to save waiting time and to maximize hauling time. Figure 5 depicts one example of a tractor trailer.

<sup>18</sup> Source: LogisticsWorld website, < <http://www.logisticsworld.com/logistics/wxc.htm>>.

<sup>19</sup> Source: Inventory Operations Consulting L.L.C. website, < <http://www.inventoryops.com/dictionary.htm#Top>>.

<sup>20</sup> Source: <<http://www.speakeasy.org/~peterc/nicaragua/drycanal/container/shipng12.htm>>.

<sup>21</sup> Source: Palmer, John. "Level Loading and Cross Docking in a Global Logistics Network."



**Tractor**

**Trailer**

Figure 5. Picture of a tractor trailer.<sup>22</sup>

**Warehouse** – A warehouse is a distribution center that carries goods for an extended period of time, which would be necessary for goods that are subject to seasonal production or demand.<sup>23</sup> A warehouse may appear similar to a hub in that both can regulate mismatches between supply and demand; however, a warehouse is intended for storage and, generally, for a longer storage period than that for a hub, rather than to facilitate the movement of goods through a network.

**Hub** – A hub is a central facility through which all shipments pass in a transportation system.<sup>23</sup> It can also be thought of as a site that provides a central repository for inventory to provide a central planning capability in an industry or supply network.<sup>24</sup> The benefit of using a hub is to pool resources and reduce the amount of inventory by keeping it in a centralized location in the network until the point at which the material is needed. A hub is also useful when shipment volumes and frequencies are mismatched with production usage.

**Third-Party Logistics Provider (3PL)** – A company or entity that provides the outsourcing services for all or part of a company's logistics needs. A 3PL may manage inventories and reorder points, store goods, and handle consolidation and transportation, among other services. UPS Supply Chain Solutions and Penske Logistics are among the top 10 largest 3PL companies in the world.<sup>25</sup> Using a 3PL may be desirable if a company has deficient logistics competencies or resources and it desires flexible logistics capacities, or it wants to take advantage of volume discounts that can be achieved by a 3PL.

**Truckload (TL)** – A shipment in which the freight completely fills the truck or trailer.<sup>26</sup> This terminology applies to containers, as well, and is referred to as a container load (CL). Sometimes the terminology full truckload (FTL) and full container load (FCL) will be used and have the same meaning.

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<sup>22</sup> Source: Hanks truck website, <[http://www.hankstruckpictures.com/pix/trucks/ross\\_burnham/june2003/bj\\_tractor\\_trailer.jpg](http://www.hankstruckpictures.com/pix/trucks/ross_burnham/june2003/bj_tractor_trailer.jpg)>.

<sup>23</sup> Source: LINDO Systems website, <<http://www.lindo.com/glossary.pdf>>.

<sup>24</sup> Source: Inbound Logistics website, <<http://www.inboundlogistics.com/glossary/index.shtml>>.

<sup>25</sup> Source: Logistics List website, <<http://www.logisticslist.com/>>.

<sup>26</sup> Source: LogisticsWorld website, <<http://www.logisticsworld.com/logistics/wxc.htm>>.

**Less Than Truck Load (LTL)** - A shipment that does not fill an entire truck or trailer. LTL shipments are often consolidated by a third-party logistics provider, known as an LTL carrier, into full truckload shipments. LTL carriers will use strategically placed hubs to consolidate LTL shipments from many sources or customers and sort these shipments into full trucks destined for a location or region.<sup>27</sup> Some examples of these companies include Yellow Freight and U.S. Freightways.

**Direct Shipment** – Transporting goods directly from the supplier to the customer’s point-of-use location without the use of an intermediary distributor, warehouse, or hub. Direct shipments may come in the form of truckloads, container loads, railcar, LTL, or LCL deliveries.

**Lane** – A lane is a dedicated shipping route between a specific origin and destination pair that could be defined by city, state, or country.<sup>28</sup> Kodak has dedicated lanes that are used to deliver raw materials, transport goods and materials between Kodak locations, and ship finished products to warehouses or customers. Some examples of Kodak’s shipping lanes include the following: suppliers in Buffalo, NY to Kodak in Rochester, NY; Kodak Park in Rochester, NY to Kodak site in Windsor, CO; and Shanghai, China to Rochester, NY.

**Utilization** – Utilization or cube utilization is an indicator of the amount of space consumed by freight in a truck, trailer, or container, and it is generally calculated as a percentage of the total available space.<sup>27</sup> For example, if a trailer is capable of carrying 48 standard pallets and it is only filled with 36 pallets, then the utilization of this trailer is 75%. Figure 6 illustrates the concept of utilization. Utilization is an important metric in determining transportation efficiencies with the constant goal of being able to maximize utilization in order to reduce per-pallet or per-unit transportation costs.

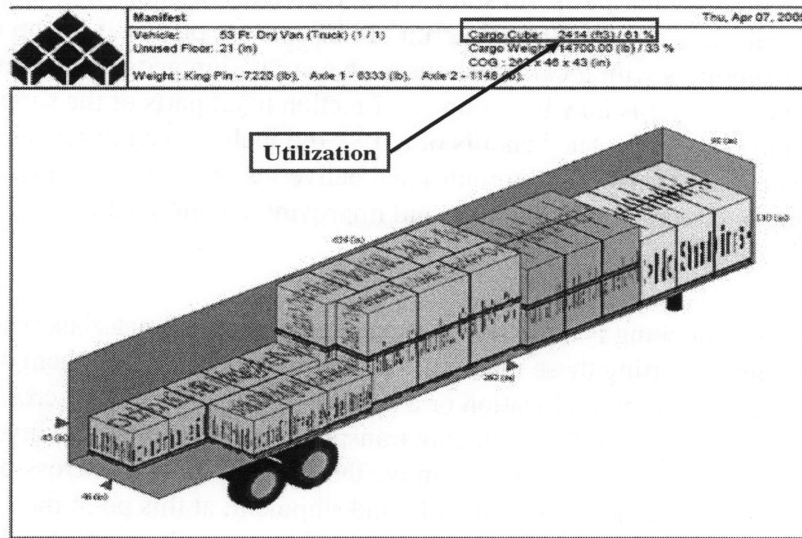


Figure 6. Pallet utilization in a trailer.<sup>29</sup>

<sup>27</sup> Source: Inventory Operations Consulting L.L.C. website, <<http://www.inventoryops.com/dictionary.htm#Top>>.

<sup>28</sup> Source: LINDO Systems website, <<http://www.lindo.com/glossary.pdf>>.

<sup>29</sup> Source: Garbach, Ray. “Kodak Inbound Fast Flow Process.” Presentation given at Eastman Kodak Company.

**Lead Time** – Lead time is the total amount of time it takes from the order point to the point of delivery where the item is available for use. This total lead time is a summation of order lead time, manufacturing lead time, and transportation lead time;<sup>30</sup> however, it may not always include all three of these components, and there are several levers that can be used to affect these lead times. For example, manufacturing lead time can be eliminated if finished goods are stored at the supplier and ready for shipment upon the receipt of an order. Order lead times can be drastically reduced through electronic data interchanges and transportation lead time can be reduced by using a hub or distributor.

**Landed Cost** – A method of costing materials that includes not only the piece price, but also all of the expenses related to ordering and delivering the goods. Some of these additional costs may include transportation costs, import duties and fees, taxes, inventory holding costs, and warehousing and handling charges.<sup>30</sup>

**Incoterms** – Incoterms, or International Commercial Terms, were first published by the International Chamber of Commerce and specify the obligations of the buyer and seller throughout the shipping process.<sup>31</sup> The defined responsibilities include carriage of goods, export/import clearance, risk of loss, and payment of freight cost. Incoterms do not relate to the transfer of the title of goods. Each Incoterm consists of the Incoterm itself, the named place, and the freight payment terms.<sup>32</sup> For example, Free on Board, or FOB, is an Incoterm with which many consumers may be familiar. In simplistic terms, FOB indicates that the supplier has responsibility for preparing the goods and getting them onto the carrier’s vehicle or vessel, and the buyer is responsible for all subsequent shipping costs and requirements.<sup>32</sup>

**Milk Run** – A milk run consists of a pickup or delivery route with several stops along the way which is usually run on a regular basis. In some cases, deliveries of goods or empty containers and pickup of materials may occur in the same run. Milk runs are primarily set up with local suppliers, or distant suppliers with local warehouses, that are within geographic proximity to each other;<sup>33</sup> however, milk runs may be set up and function in all parts of the supply chain— inbound, internal, and outbound. The benefits of a milk run include having regularly scheduled, predictable material orders, transportation routes and deliveries, thus reducing inventories, leveling the shipping and receiving workloads, and improving communication and visibility in the supply chain.<sup>33</sup>

**Cross-Docking** – Cross-docking is the activity of unloading inbound materials coming from a common region or source, sorting these materials, and immediately loading them onto outbound trucks that are headed for a common location or a regional route. The goal of cross-docking is to eliminate the need for warehouses, thus reducing transportation lead times and inventories. In some cases, it may take days or even weeks to move the material through a cross-dock, especially if consolidation is required for an outbound shipment; at this point the “cross-dock” is essentially functioning as a warehouse.<sup>30</sup> Cross-docking is commonly used when large

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<sup>30</sup> Source: Inventory Operations Consulting L.L.C. website, < <http://www.inventoryops.com/dictionary.htm#Top>>.

<sup>31</sup> Source: Export.gov website, < <http://www.export.gov/incoterms.html>>.

<sup>32</sup> Source: “Incoterms.” Presentation given at Eastman Kodak Company, Rochester, NY.

<sup>33</sup> Source: Baudin, Michael. Lean Logistics: The Nuts and Bolts of Delivering Materials and Goods.



shipments of material are intended for multiple points of use but are originating from one supplier or region. Cross-docking is common in a hub-and-spoke network configuration such as in FedEx's network where many packages in the U.S. are routed through Memphis, one of FedEx's six U.S. hubs.<sup>34</sup> Figure 7 illustrates the concept of cross-docking at Kodak.

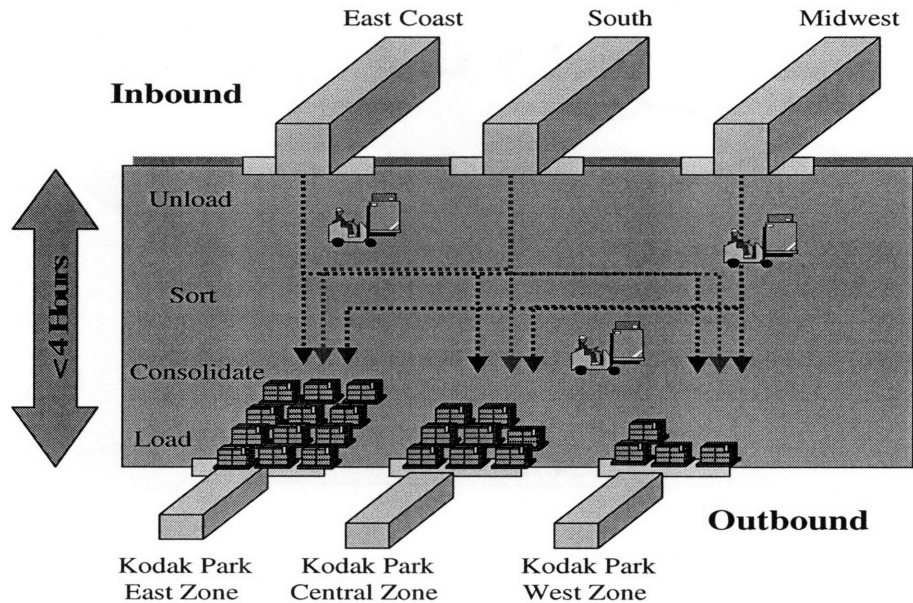


Figure 7. Cross-docking illustration.<sup>35</sup>

**Fast Flow** – Fast flow is a term that has been coined by, and is unique to, Kodak. Fast flow is defined as a combination of milk runs and cross-docking. More specifically, fast flow involves inbound milk runs delivering a “neapolitan” mix of goods to a cross-dock facility that off loads, sorts, and prepares the goods for outbound shipments to one or multiple points of use. Figure 8 illustrates fast flow for materials moving from the supplier to Kodak. If the outbound shipment contains goods for multiple usage locations, then this part of the supply chain is also defined as a milk run. This thesis will not focus on the delivery of outbound goods to the points of use once the goods reach the cross-dock. The tenet behind fast flow is “Order today, what you used yesterday, for delivery or consumption tomorrow.”<sup>35</sup>

<sup>34</sup> Source: FedEx Express website, < <http://www.fedex.com/us/about/news/hubs.pdf?link=4>>.

<sup>35</sup> Source: Garbach, Ray. “Kodak Inbound Fast Flow Process.” Presentation given at Eastman Kodak Company.

### “Supplier to Kodak” Fast Flow

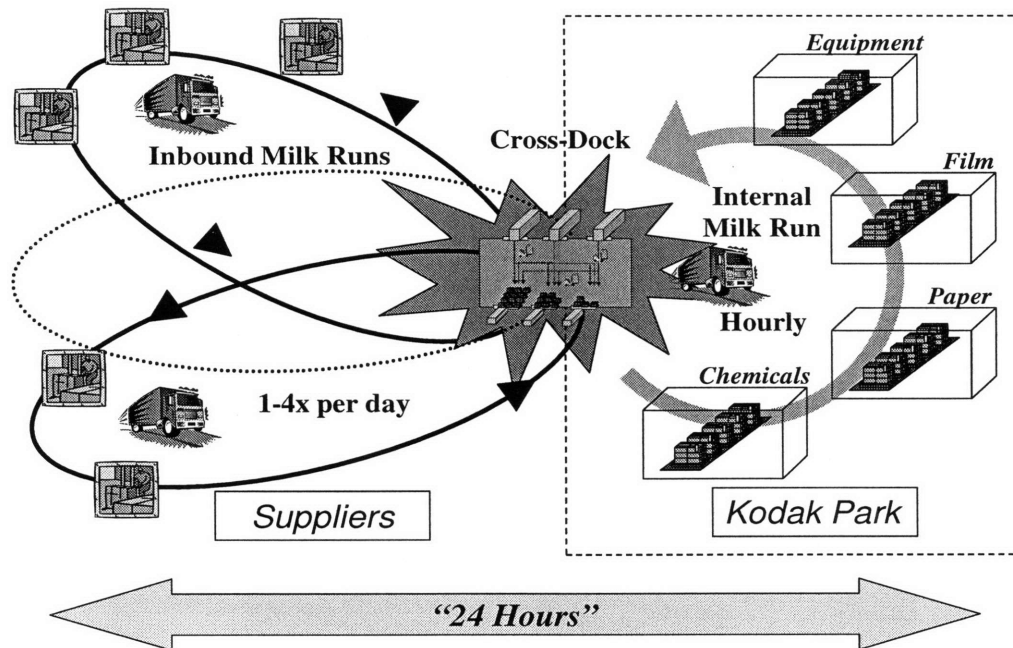


Figure 8. Fast flow material movement.<sup>35</sup>

**Consignment** —American Production and Inventory Control Society (APICS), The Association for Operations Management, defines consignment as, “The process of a supplier placing goods at a customer location without receiving payment until after the goods are used or sold.”<sup>36</sup> Consignment may be used by the customer to reduce its inventories from a financial perspective or to increase the supplier’s responsibility for inventory management and monitoring.

**Vendor-Managed Inventory (VMI)** - APICS defines vendor-managed inventory as, “A means of optimizing supply chain performance in which the supplier has access to the *customer’s inventory* and is responsible for *maintaining the inventory level* required by the customer.”<sup>36</sup> This practice is common for commodity-type parts such as nuts and bolts, which are not significant enough for the supplier to be concerned with managing and controlling inventories and reorder points. Vendor-managed inventory may be owned by the vendor (consignment inventory) or the customer.<sup>37</sup>

**Foreign Trade Zones (FTZ)** – Foreign trade zones are designated secure areas within the United States that are considered to be outside the customs territory of the U.S. The purpose of these zones is to improve international competitiveness, encourage commercial and industrial operations, and create employment in the U.S.<sup>38</sup> Duties and fees are not paid on goods that enter

<sup>36</sup> Source: Blackstone, John and James Cox. *APCIS Dictionary*, 9<sup>th</sup> Ed.

<sup>37</sup> Source: Inventory Operations Consulting L.L.C. website, < <http://www.inventoryops.com/dictionary.htm#Top>>.

<sup>38</sup> Source: Dellefave, Maria. “Eastman Kodak Foreign Trade Zone.” Presentation given at Eastman Kodak Company

into an FTZ until they are removed from an FTZ. Duties and excise taxes are not paid on the goods if they never leave an FTZ to enter into the U.S. and are subsequently exported. FTZs are the U.S. equivalent to free trade zones that exist in other parts of the world.<sup>39</sup>

A building or facility can be activated as a foreign trade zone, but all of the items in that building may not be under the FTZ umbrella. In other words, an FTZ is not as much a physical place or visible characteristic as it is a status for an item. Items under the FTZ classification could be stored next to those that are non-FTZ items, and it may not be possible to determine if an item is an FTZ item merely through visible inspection. Instead, the inventory tracking and planning system would have to be consulted.<sup>40</sup>

There are two types of FTZs: general-purpose zones and subzones. General-purpose zones are usually located at international shipping ports or airports and can be utilized by the general public. Subzones are a specific type of FTZ that are unique to an individual or firm and are established when a specific function, such as proprietary or capital-intensive manufacturing, cannot feasibly be done in a general-purpose zone.<sup>39</sup> An extensive application and security process is necessary to gain approval from U.S. Customs to establish and operate an FTZ. Currently in the U.S. there are 240 communities with FTZs, 50 states with zones, and over 60 applications for new or expanded zones in progress. In 2001, \$225B in merchandise was handled by FTZs, and 330,000 people were employed at active zone facilities in the U.S.<sup>39</sup>

## 2.6 SUMMARY

This chapter provided a brief introduction to logistics, supply chain, and the concepts of lean. In addition, it presented and defined some basic terminology related to transportation and logistics. The key concepts and takeaways from this chapter are as follows:

1. Logistics is defined as all of the operations that are needed to deliver goods and services, except for making the goods or performing the services.<sup>41</sup>
2. Logistics describes the flow of three items through the supply chain: material, information, and finances.
3. Kodak's supply chain is divided into three segments: supplier-to-Kodak, Kodak-to-Kodak, and Kodak-to-customer.
4. The objective of lean logistics is to deliver the materials needed, when needed, in the quantity needed, and conveniently presented to the customer with as little waste as possible.<sup>41</sup>

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<sup>39</sup> Source: Export America website, [http://www.export.gov/exportamerica/TechnicalAdvice/ta\\_foreign\\_trade\\_zones\\_0203.html](http://www.export.gov/exportamerica/TechnicalAdvice/ta_foreign_trade_zones_0203.html).

<sup>40</sup> Source: Strong, Joseph. Personal interview.

<sup>41</sup> Source: Baudin, Michael. Lean Logistics: The Nuts and Bolts of Delivering Materials and Goods.

5. The key concepts of lean that are important to this thesis are heijunka, or production leveling, continuous flow, takt, and pull.
6. Third-party logistics providers (3PLs) are entities that provide outsourcing for all or part of a company's logistical needs.
7. Fast flow is a logistics term that is unique to Kodak and describes a combination of milk runs and cross-docking.
8. Foreign trade zones (FTZs) are designated areas within the U.S., which are outside the customs territory of the U.S., that eliminate or postpone the payment of duties, fees, and excise taxes on goods until they are exported or leave the FTZ. The purpose of FTZs is to improve international competitiveness, encourage commercial and industrial operations, and create employment in the U.S.<sup>42</sup>

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<sup>42</sup> Source: Dellefave, Maria. "Eastman Kodak Foreign Trade Zone." Presentation given at Eastman Kodak Company

## **CHAPTER 3 INBOUND LOGISTICS AT KODAK**

The focus of this thesis is on inbound logistics in Kodak's supply chain. The reason for focusing on inbound logistics will be explained, and the following areas of Kodak's inbound logistics organization will be described: the history, the existing circumstances at the start of this thesis, and the stakeholders involved.

### **3.1 STAKEHOLDERS**

This thesis project was initiated by the Global Logistics group, which is within the corporate Global Manufacturing & Logistics (GM&L) organization; however, there are many other stakeholders in Kodak's inbound supply chain. Within GM&L are the Demand & Supply Planning (D&SP), Worldwide Purchasing, and the operations functions. Demand & Supply Planning is responsible for the day-to-day logistics operations and material planning. Worldwide Purchasing handles the contracts and negotiations with suppliers and oversees material procurement functions. Operations comprise all of the manufacturing functions for the four major business units. These four players, Global Logistics, Demand & Supply Planning, Worldwide Purchasing, and Operations are key stakeholders in this thesis work. The other internal stakeholder is Global Logistics Finance, which is part of the Corporate Finance Group, a parallel organization to GM&L. Stakeholders in the inbound supply chain that are external to Kodak include the suppliers, distributors, carriers, and other 3PL companies.

### **3.2 WHY INBOUND?**

Initially, Kodak's inventory reduction and lean logistics activities focused on finished goods; this was a logical starting point for several reasons. First, given that customer focus is an important concept in lean theory, finished goods inventories intended for the customer were the starting point for the lean improvement journey. Second, finished goods are of greater value to Kodak than the raw materials alone; therefore, they created a large value proposition to encourage Kodak to reduce these inventories and push finished goods through the supply chain out to the customer. Third, there was more available information on the inventories and the flow of materials in the Kodak-to-Kodak and Kodak-to-customer portions of the supply chain, so this made for an easier starting point for inventory reduction initiatives. While ongoing work had led to some inventory reduction in the supplier-to-Kodak space, it still contained some uncharted territory and a lack of standardization due to the complexity of materials, suppliers, and business units that were involved. As Earl Chapman, KOS expert for Global Logistics put it: inbound logistics was like the "wild, wild West."

One can imagine that as raw materials are gradually converted into finished products, the number of unique materials and flow paths gradually decrease throughout the process. Figure 9 depicts this supply chain trend.

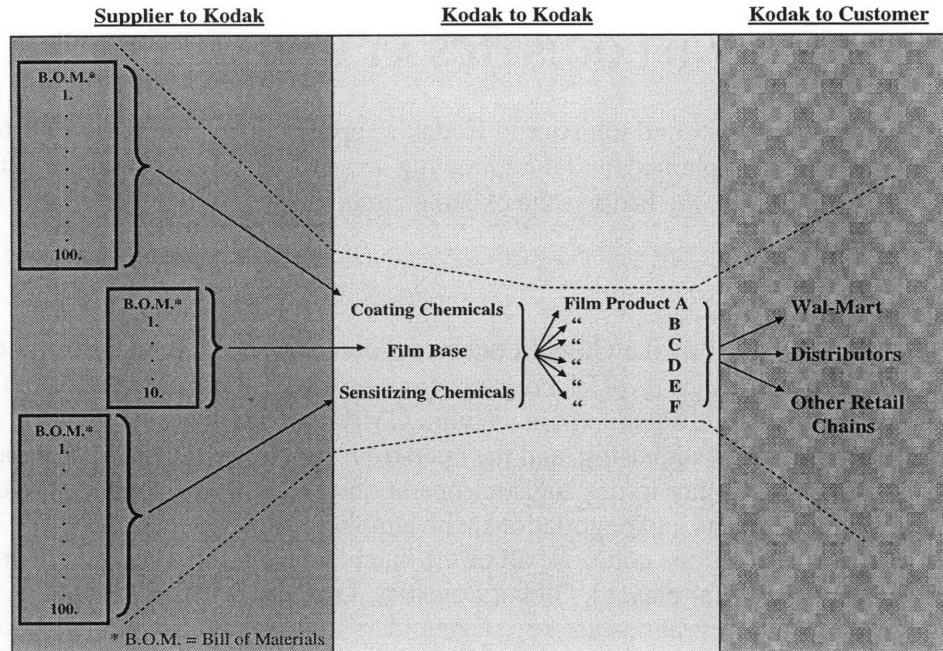


Figure 9. Inbound raw material complexity in Kodak's supply chain.

This scenario is especially true for traditional products such as film and paper that go through the complete manufacturing process, end to end, under Kodak's roof. Kodak starts with raw materials to manufacture film and paper base and also supplies the chemicals used to coat and sensitize these media. As a result, Kodak's inbound supply chain, the portion representing raw materials flowing from the supplier to Kodak, is one of the most complex pieces of the logistics puzzle. This complexity and the initial lack of coordination and focus on inbound material logistics led to the creation and implementation of many different solutions to handle raw materials going into Kodak sites; consequently, the inbound supply chain became the target area of focus for this thesis work.

### 3.3 BACKGROUND

Inbound logistics at Kodak has gone through several phases over approximately the last decade. In the late 1990s, Kodak decided to pursue a hub strategy with a third party. This 3PL leased warehouse space from Kodak but was responsible for managing and handling inventories and developed the IT systems necessary to do so. Initially, the trend was to put "everything" into the hub; this trend and the hub itself have fizzled down from approximately 45 suppliers to as few as 15 or less suppliers at the start of this thesis. Eventually, during the course of this project, most of the goods were pulled from the hub, it was relocated to a manufacturing site, and was intended to be used mainly for that site's materials. During the existence and prosperity of the hub era, fast flow was initiated, and became *the* strategy to follow.

Fast flow came onto the scene for Kodak in 2002. It resulted from benchmarking the relationship between Toyota, the Japanese automaker, and Transfreight, a third-party logistics provider. Transfreight is a lean cross-dock specialist and is solely responsible for inbound parts

logistics for Toyota's assembly plants in North America.<sup>43</sup> Fast flow's combination of inbound milk runs and cross-docking was intended to create coordination and standardization in the inbound space by addressing the following problems:<sup>43</sup>

1. Each plant was independently managing material movement from common suppliers. As a result, material managers could not take advantage of transport-consolidation opportunities.
2. Because some suppliers selected the carriers and controlled inbound movement, Kodak had no control over these shipments. As a result, unscheduled material deliveries were being made at the warehouse and plants. This caused poor utilization of material handling and floor space at all facilities.
3. Inventories were not visible in-transit, which made production scheduling much more challenging and, at times, negatively affected production operations.
4. Order cycle times were long.
5. In some cases, suppliers held shipments until they had a full trailerload. Although this practice resulted in lower transport costs, it also increased lead times and inventories. Consequently, Kodak had high inventory levels at the warehouse and plants which resulted in congested facilities and high inventory carrying costs and storage costs.

The hub strategy was not specifically designed to resolve most, if any, of these problems. Fast flow, on the other hand, may have provided a great solution to these issues; however, it was not economically feasible to implement for bulk materials or those with long lead times or low volumes.<sup>44</sup> In addition, fast flow does generate some waste in the supply chain through cross-docking activities, and it does not totally eliminate the carrying cost of inventory for Kodak.

During the same period that fast flow was gaining popularity, so too was consignment. Consignment effectively achieved "zero days" of inventory—financially—for Kodak, whereas fast flow would always have a one to two day buffer. Consignment tended to work well for long lead time items; however, it did not necessarily address any of the logistics problems listed earlier that fast flow resolves. Throughout this thesis work, there was a constant struggle between the lean tenets of fast flow and the zero days of inventory, which was ultimately desired by the company.

Through this historical account of Kodak's inbound logistics strategies and the subsequent investigation into each, it became apparent that there was no one-size-fits-all strategy that would be right for Kodak's supply chain.

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<sup>43</sup> Source: Cook et al. "A Lean Approach to Cross Docking."

<sup>44</sup> Source: Jones, Edward C. Personal interview.

### **3.4 EXISTING PROJECTS AND INITIATIVES**

At the onset of this thesis work, there were several ongoing, related initiatives at Kodak. These projects were related to consignment, new logistics solutions, purchasing contracts, and hubs. The existence of these projects revealed the current state of Kodak's logistics operation indicating that there were many involved stakeholders with varying approaches and ideas regarding inbound logistics. This, in turn, demonstrated a pull for the standard logistics solutions and decision tool that were developed as a result of this thesis work.

#### **3.4.1 Focus on Consignment**

The initial focus of this project was on consignment and the many different implementations of consignment throughout the organization. The intent was to understand how each of these methods operated, how they were different, and why one might be better than another or better for one situation over another. Part of the reason for this focus was the company's strong push to move all inbound materials to consignment so that Kodak effectively had zero days of inventory. This goal was not selective to a particular material, supplier, or business unit but was rather a blanket statement for all inbound materials. It was decided to broaden the scope of the project beyond consignment after the initial investigation; however, three main consignment applications were still investigated: consigned chemicals for the Photo Chemical division, Felix Schoeller paper base coming from Europe, and digital cameras manufactured by OEMs in Asia.

#### **3.4.2 Purchasing Contract Evaluation**

At the beginning of this thesis work, a project to evaluate the status of purchasing contracts was in its late stages. The purpose of this project was to evaluate Kodak's existing contracts with suppliers to determine if an inventory management method was specified in the contract and, if so, if the actual material and information flow from the supplier to the business unit was operating according to the contract. Some of the contract facets that were evaluated included delivery terms, level of inventory, and delivery location.<sup>45</sup> The status of each contract and relationship was investigated and documented to determine the percentage of contracts with a specified inventory management method and, of those, what percentage were operating to specification. The next logical step of this project was to institute logistics standards in contracts that were lacking them or to correct situations in which material was not flowing according to the terms set forth in the contract. The process by which a logistics solution was chosen was not specified or standardized, and it seemed to vary by business unit; however, the following methods were observed by the project team: the material flow decision was made by a small cross-functional team of purchasing and operations personnel, the existing process flow was not changed and simply documented in the contract, or it was setup between operations and the supplier with subsequent notification going to purchasing personnel.<sup>45</sup> The results and conclusions of this project demonstrated the need for a standard decision process and a set of logistics solutions, it and created interest and appeal for this proposed thesis work.

#### **3.4.3 Third-Party Hub Initiative**

Another project that was initiated during the course of this thesis work investigated a strategy by which chemicals would be moved to a third-party hub location with inventories being owned and

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<sup>45</sup> Source: Ghazanfari, Hossein and Peter Schmit. Personal interview.



managed by the third party.<sup>46</sup> This project was also spearheaded by the purchasing organization, and it is interesting because some of the objectives and issues being addressed were closely related to this thesis work on a site-specific level. Some of the commonalities included the desire to reduce inventories, move inventories off Kodak's property, and utilize a third-party owned and managed hub. While the objectives and terminology referred to here will be discussed in later chapters, the repeat occurrence of these issues once again demonstrates the corporation's desire to gain control of its inbound material flows and reduce logistics ambiguity and costs.

#### **3.4.4 CMIS Browser**

Early on in this thesis project the only information available on inbound materials included two databases. One was a database that was created and maintained by Purchasing and contained information on the suppliers with which Kodak had its highest annual spend for 2004 and the beginning of 2005. This database included the suppliers' addresses, the pertinent contacts at the suppliers and Kodak, and Kodak's annual spend with these suppliers. The second database had been developed by the logistics organization with the help of Finance and was called the Cost Management Information System (CMIS). The CMIS database contained snapshots of inventory levels and purchases for Kodak's raw materials, work-in-process (WIP) materials, and finished goods.

While these two databases contained reliable information and were useful for the purposes and users for which they were created, they did not help to build a unified picture of the state of inbound materials. A huge gap was discovered when trying to marry the information from these two databases. The first database contained names of suppliers but did not contain the products that the suppliers provided; the CMIS database contained a list of materials and inventory levels but did not indicate who the suppliers were for these items. In addition, the Purchasing database contained supplier billing addresses. This information was practically useless to a logistics organization that was trying to consolidate transportation because often these addresses were different from the locations where goods were actually manufactured or shipped from.

In order to close this gap, a tool called the CMIS Browser was created with input and resources from purchasing, finance, and logistics. The tool pulled information from fields in SAP to populate a Microsoft Access database with a front-end user input screen. Purchasing played a key role in helping to identify the fields in SAP that contained the desired information. The development of this tool was headed by Mark Ewanow of the Global Logistics organization. Users of the tool in the logistics organization, including me, identified opportunities to add functionality and information to the tool, which led to several revisions and ultimately a very powerful tool. Finance provided monthly reports to populate the fiscal data and also oversaw the issues related to confidentiality and information sharing associated with the database.

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<sup>46</sup> Source: Grant, Peter. Personal interview.

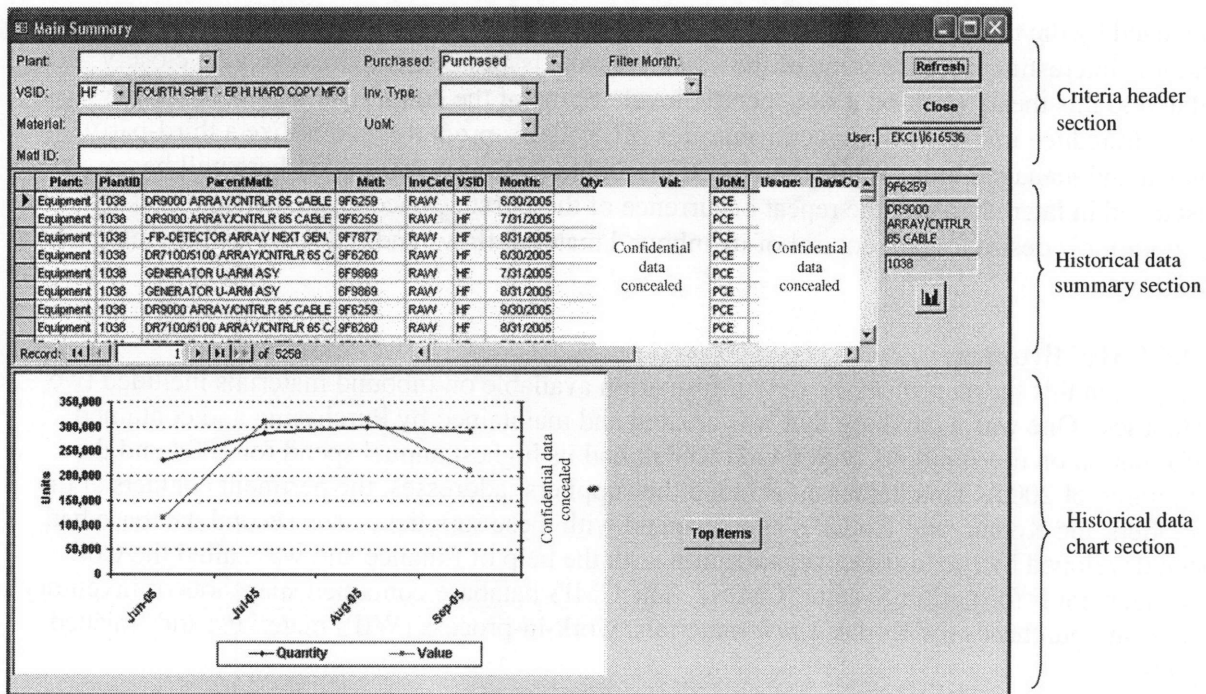


Figure 10. CMIS Browser main user interface summary.

In approximately four months, from the discovery of the inbound materials information gap to the end of this thesis work, the tool went from non-existent to a recognized resource that could be used by a multi-functional set of users across Kodak's global operations. Purchasing could use the tool to monitor purchase values and quantities of products throughout the year and determine all the materials being bought from a supplier even if those materials were owned by different commodity managers or were used at different sites. Planners and operations people could use the tool to monitor their inventory levels in one simple snapshot. Individual business units could determine if other business units were using the same materials or suppliers. And finally, logistics could start to build a map of physical material flows since the tool allowed for searches of suppliers located in a particular country, state, city, or zip code.

Although the need for this tool was identified during this research process and I provided input for improvement, development of the CMIS Browser was not part of this thesis work but rather supplemental to it by ultimately making available the necessary information regarding Kodak's inbound materials.

### 3.5 SUMMARY

Kodak's inbound logistics operations involve many stakeholders including Global Logistics, Demand & Supply Planning, Worldwide Purchasing, Operations, and Finance. Because of a lack of focus and standardization, Kodak's inbound supply chain presented the most opportunity for improvement. In addition, several ongoing projects, such as the focus on consignment, purchasing contract evaluations, and the third-party hub initiative, further demonstrated the lack of coordination and the desire to improve Kodak's inbound logistics.

## CHAPTER 4 INBOUND LOGISTICS SOLUTIONS

In order to develop a standard set of logistics solutions that fit with Kodak's inbound logistics strategy, the existing state of Kodak's inbound supply chain was investigated. Based upon the investigation findings, logistics terminology was defined and classified, and a standard set of endorsed logistics solutions was established.

### 4.1 EXISTING PRACTICES

In order to improve Kodak's inbound supply chain, the first step was to understand the current state of inbound materials. The initial focus was on inbound items to Kodak Park in Rochester, NY, due to the proximity of the site as well as the breadth of products and business units located there. Through interviews with buyers and planners, logistics experts, and manufacturing personnel, the following list of existing logistics solutions was developed: consignment, standard terms, extended terms, direct shipment, fast flow, hub, warehousing or storage, and foreign trade zones. These methods will be further defined and elaborated upon in section 4. Kanban was a method that was cited quite often in interviews but it is not included in the list. Kanban is a signal used to reorder material; it is not a logistics solution. Some information regarding the utilization and implementation of these solutions in specific situations was captured to gain an understanding of what characterized a solution, how that solution was implemented, and why that particular solution was put into place.

The next step on this continuous improvement path was to create a standard for the existing practices. For example, one site's implementation of fast flow actually represented the direct shipment model. The tenet behind this phase was to stabilize the current state and gain order before trying to move forward to make any changes to improve it. Information from those interviewed, as well as from industry publications, practices, and experts at Kodak, was collected to create a complete picture of each solution and all of its potential applications.

Next, definitions were created that drew from industry standards but also conformed to the existing practices and criteria of Kodak's inbound supply chain. In some cases, terminology was inserted or redefined to fill in any identified gaps and prevent uncertainty or confusion. Extended terms are explained below and are an example of this situation. These definitions were validated with a cross-functional group of people from Purchasing, Planning, Logistics, and Operations and across several sites beyond Kodak Park. The validation process is detailed in Chapter 6.

#### 4.1.1 Consignment

The APICS definition for consignment, "The process of a supplier placing goods at a customer location without receiving payment until after the goods are used or sold,"<sup>47</sup> was adopted to comply with industry standards and to avoid creating a Kodak-specific consignment process. As such, in order to maintain the standards of the APICS definition, we stipulated specific requirements to maintain these standards in Kodak's inbound supply chain:

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<sup>47</sup> Source: Blackstone, John and James Cox. *APICS Dictionary*, 9<sup>th</sup> Ed.

1. The goods must be visible in Kodak's planning system, prior to Kodak's accepting ownership, regardless of their inventory location.
2. There is no aging clause, meaning there is no set point in time by which the goods transfer into Kodak's ownership if they are not used.

In many cases, inbound materials were classified as being on consignment, but an aging clause existed in the contract. The above requirements became necessary in order to differentiate consignment agreements and practices from those that were not, and to reduce confusion in Kodak's existing operations. Furthermore, in order to be consistent with the industry standard definition of consignment, in which goods transfer ownership only when they are *used* or *sold*, the terminology "extended terms" was put into place to represent these scenarios. Extended terms contracts were found to be quite common during this thesis investigation and some of these anomalies are documented below in section 4.3.

Consignment can be used to quickly and almost completely reduce the financial effect of inventories by requiring that the supplier own the title and risk of loss for the goods until they are used or sold. This can serve as an incentive to the supplier to help reduce and better manage inventory in the supply chain. On the other hand, this cost to carry capital may just be passed on to Kodak through an increase in piece price. If this is the case, then the supply chain inventory may not be reduced but just passed on to another player in the supply chain. In addition, it is recognized that there are administrative costs associated with monitoring and tracking the status of consigned goods and reconciling consignment inventories at the end of each month. From personal interviews with several product groups, the additional time required for reconciling consignment inventories ranged from a few hours a month, to a few days, to having to hire an extra person just to manage consignment contracts!

It would seem, then, that a piece price increase, additional administrative costs, and no overall reduction of inventory in the supply chain would be a heavy load to accept just to get rid of the financial burden of inventory. In actuality, even if there is a piece price increase, it may still be financially advantageous to Kodak to accept it if the supplier's cost to carry capital or insurance rate is less than Kodak's, if there is a large sum of money tied up in inventory, or if the inventory volume spans several weeks or months of supply. These factors will be discussed further and incorporated into a financial model that will be discussed in section 5.4.7 and included in Appendix J.

#### **4.1.2 Extended Terms**

Extended terms describe a scenario in which transfer of ownership occurs after a set number of days or upon consumption, whichever occurs first. This model was popularized by the number of existing contracts that specified ownership transfer at the time of consumption but also included an aging clause that made it possible for ownership transfer to occur before goods were consumed. In some cases, an aging clause existed but was never satisfied meaning that the goods are always consumed before the time limit; regardless, these scenarios are still considered to be extended terms rather than consignment terms. Another difference between extended terms

and consignment terms is that there is no requirement for goods to be visible in Kodak's planning system under an extended terms contract.

There are several characteristics of extended terms contracts that should be considered. First, given that they are similar to consignment contracts, but with an aging clause, they are still susceptible to the administrative costs that are required to track and reconcile inventories. These activities and costs may actually present a greater burden with extended terms contracts because the aging clause has to be monitored, and it can create an additional transaction if it expires and the ownership transfer occurs before the goods are used. Second, if ownership transfer occurs before the good is used or sold, insurance, storage, and handling costs may create unanticipated financial obligations for Kodak. Finally, it is presumed that the supplier is compensated in one form or another for agreeing to hold inventories on its books. As a result, it is desirable for Kodak to match the aging clause as close to the actual inventory holding timeframe as possible to avoid "paying" for inventory-carrying days that are not being utilized by Kodak.

#### **4.1.3 Standard Terms**

Standard terms represent a more traditional and simple method of operation in which the point of ownership transfer occurs when Kodak or Kodak's preferred carrier picks up the goods or, if the supplier takes responsibility for shipping, the goods are received at Kodak's dock. This transfer of ownership point is generally implied by the shipping terms or Incoterms of the transaction, even though the Incoterms do not call out the specifics of title transfer. The most common and preferred Incoterms in Kodak's inbound supply chain are those in which Kodak, the buyer, designates the carrier and pays for transportation.<sup>48</sup> Therefore, in these situations it is usually agreed upon that the title transfer will occur when Kodak's designated carrier picks up the goods. As a result, using standard terms simplifies contract negotiations with suppliers and standardizes transportation responsibilities and inventory ownership transfer in the inbound supply chain. There is a potential negative side to standard terms contracts if expensive goods are shipped over long distances during which time Kodak cannot use or sell these goods but must carry the inventory on its books.

#### **4.1.4 Direct Shipments**

In general, the term direct ship applies to goods that are delivered straight to the customer's warehouse or point of use. A direct shipment may include a railcar delivery, a full truckload of goods, or an LTL or LCL shipment from a supplier or distributor. A full container or railcar could represent several weeks to months worth of material, thus resulting in the need to store inventory that takes up space, is costly, and can increase the risk of loss, damage, or obsolescence. On the other hand, transportation costs for small, partial shipments such as those sent by LTL or LCL methods are generally quite pricey when compared to full shipments. Once again, in attempting to establish lean logistics practices, a balance must be achieved between eliminating waste and reducing cost.

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<sup>48</sup> Source: "Incoterms." Presentation given at Eastman Kodak Company, Rochester, NY.

In order to meet this balance and develop standard inbound logistics practices, the definition and application of direct shipment for Kodak's purposes is further constrained: Direct shipments should be full trucks from one supplier or distributor delivering quantities representing a day or less of supply to one point of use. The intention of this practice is to maximize transportation efficiency and minimize waste. Ideally, a direct shipment of goods should not have to be stored off line away from the point of production or put away when it is received because this creates waste in the form of unnecessary material movement and inventory. The following list outlines in detail some of the requirements necessary to minimize waste and achieve the intended goals of direct shipments:<sup>49</sup>

- Manufacturing consumes more than 50 to 80% of a truckload per day.
- The carrier can deliver at the time, frequency, and quantity manufacturing wants, and can do so economically.
- Manufacturing has the space, dock doors, and staff to unload when the truck arrives.
- The manufacturing people can do the necessary receipt transaction.
- The building is accessible to the carrier's trailer.
- Manufacturing is not double handling the material by storing it or putting it away.
- Pallets on a consolidated load have been properly sequenced for unloading.

If direct shipments are utilized in the manner specified here, the result can be one of the leanest and most desirable logistics solutions. Daily scheduled deliveries reduce inventories and waiting, and they increase visibility in the supply chain. Refraining from putting away material eliminates excess transportation and motion, and properly sequenced truckloads prevent wasted motion and overprocessing of pallets. Unfortunately, due to geographic limitations and the volumes required to fill a truck, it is estimated that direct shipments are applicable to approximately 5% or less of Kodak's inbound materials by value.

#### **4.1.5 Fast Flow**

In Chapter 2, the general definition of fast flow was described as a combination of inbound milk runs and cross-docking. Some scenarios exist that may be mistaken for fast flow, and as a result, two specific criteria have been identified that qualify a logistics method as fast flow:

1. Goods are delivered on a daily or more frequent basis by a Kodak-managed milk run.
2. A cross-dock is used to receive, sort, and disperse goods to the points of use.

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<sup>49</sup> Source: Kaemmerlen, John. "Decision Rules for Cross Dock vs. Direct Ship."

Two common scenarios have been observed that illustrate the need for the above criteria. Both of these situations can easily be mistaken as fast flow but, in reality, represent direct ship strategies. In one case, a supplier may operate its own milk run that includes a stop at a Kodak point of use or cross-dock. Although a milk run and possibly the use of a cross-dock is involved, this does not meet the fast flow requirements because, from Kodak's perspective, the inbound shipment is a direct shipment from the supplier. Another scenario may occur in which a full truckload of goods is delivered to Kodak and cross-docked out to multiple points of use at a Kodak site. Again, even though a cross-dock is utilized, an inbound milk run is not being used to deliver the goods.

Fast flow best represents the goals of lean logistics. Fast flow can be thought of as the attempt to make transportation a leveled, continuous flow operation. It attempts to deliver small amounts of material on a daily basis so that the correct materials and quantities are received on time while minimizing waste in the form of inventory, waiting, excess processing of shipments, overproduction, and defects. The following list, partially identified by Cook et al., identifies the benefits of fast flow and relates these benefits to the concepts of lean logistics and waste elimination.

1. Better visibility of goods in transit<sup>50</sup> is created because Kodak is managing the transportation. This helps to prevent blind reorders of material without knowing what is in the pipeline, which could eventually lead to inventory build-up.
2. Reduced receipt time for goods<sup>50</sup> because the milk run shipments are expected so the dock personnel know what is coming and how much is coming and are able to route them outbound in a faster manner. This step prevents the material from waiting on the dock while Receiving figures out what it is, and it eliminates additional processing that may be required to receive goods in a non-standard format.
3. Reduced dock congestion<sup>50</sup> at Kodak's cross-dock is realized because inbound deliveries are scheduled to optimize utilization of dock doors and materials handling resources. This reduces material movement and the chance for defects that may occur on a busy dock.
4. Lower inventory levels and increased available floor space result<sup>50</sup> because only 1-2 days of supply should be at the plant. This also reduces the impact of defects because, when inventories are low, they can be identified and corrected much faster.
5. Advanced notice of delays or material shortages is generated because the drivers have a scheduled route to follow and are instructed to radio or call in any problems to Kodak's transportation planners. This helps Kodak to level production and reduce downtime in the event that raw materials are not available or there is a transportation problem.

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<sup>50</sup> Source: Cook et al. "A Lean Approach to Cross Docking."

6. Reduced driver waiting time at the supplier results because pickup times are scheduled, and it is expected that docks will be available and material will be ready for pickup at the scheduled time. This creates level work flow at the dock, creates better resource utilization in shipping and receiving, and reduces driver wait time or overprocessing if the delivered trailer is dropped in a storage yard only to be later hauled to the dock and unloaded.
7. Elimination of repacking and relabeling because the goods are delivered in smaller, more desirable quantities and are prepared, packaged, and labeled according to Kodak's specifications; this prevents overprocessing.

Despite the fact that fast flow facilitates a constant, rapid flow of materials through the supply chain, thus reducing inventories and lead times, it is not without its flaws. The reader may recognize that the act of cross-docking materials, in itself, is wasteful. Cross-docking goods requires extra material processing, motion, and transportation, and it adds an element of wait time to the overall transportation period. In addition, the excess loading, unloading, and dock handling increases the opportunity to damage the material. Finally, there is a great deal of coordination and background work that goes into setting up and operating fast flow operations smoothly. As mentioned in Chapter 2, however, this is not a perfect world and tradeoffs have to be made. In the case of fast flow, the ability to drastically reduce inventories and lead time, create level flow of materials and orders, reduce waiting, and maximize resources at shipping and receiving docks far outweighs the negative consequences.

Kodak utilized the knowledge and resources of Transfreight to establish its fast flow operations. Transfreight has a close relationship with Toyota and manages all of its cross-docking and JIT deliveries of inbound materials for Toyota plants based in the United States.<sup>51</sup> At the onset of this thesis, Kodak's fast flow operations were running smoothly and ramping up to include more materials and inbound lanes. We performed additional benchmarking to determine how Toyota handled inbound shipments from foreign suppliers in distant locations. It was discovered that Toyota handled these inbound shipments itself, but it was not apparent if a cross-docking or fast flow strategy was employed.<sup>51</sup> This finding points to the need for a hub or storage option for inventories that have long lead times.

#### **4.1.6 Hub**

The benefit of using a hub is to pool resources and reduce the amount of inventory by keeping it in a centralized location in the network until the point at which the material is needed. A hub is also useful when shipment volumes and frequencies are mismatched with production usage. For example, an ocean container holding 60 drums of chemicals may show up at Kodak Park once a month, but Kodak uses these chemicals at a rate of 2 drums per day. This mismatch creates the need for a storage location for inventory and safety stock. If a hub is used to do this, several benefits are realized:

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<sup>51</sup> Source: Liker, Jeffrey. The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer.



1. Kodak does not have to use its systems, floor space, and employees to manage inventory.
2. Kodak avoids liability for loss due to damages and shrinkage.
3. Kodak may be able to delay taking ownership of the inventory until it is needed and pulled from the hub, thus reducing the cash that would be tied up to hold inventory without having to deal with the burden of a consignment relationship.

The obvious downside to using a hub is similar to other situations where waste is generated by holding inventory and adding an extra transportation or processing step in the supply chain. Also, the services offered by a hub are not free and, ultimately, Kodak will pay for these expenses, whether directly or indirectly. An additional challenge with hubs is that a third party comes into the picture; as a result, an additional relationship must be established and maintained with both Kodak and its suppliers, and the extra participant presents more opportunities for communication breakdown in the supply chain.

During the time of this thesis work, Kodak was utilizing a hub facility at its Rochester site that was located on site in a Kodak-owned warehouse, but was rented to and operated by UPS. UPS was responsible for receiving and shipping goods from the hub, tracking inventory levels, and indicating to suppliers when to replenish stock. For this service, UPS charged fees for receiving, storing, breaking down quantities, and shipping on a per-pallet basis. The goods in this hub included those on consignment and those on extended terms contracts. In most cases, the supplier covered the costs of the hub fees; however, in the case of extended terms contracts, if the goods were held in the hub beyond the contract time limit, Kodak became responsible for the storage, breakdown, and shipping fees on goods that had transferred into its ownership.

While this was the method that Kodak was using for its hub in Rochester, this was not automatically viewed as the best method for operating a hub. As a result, benchmarking activities were initiated, and industry best practices were studied by looking at Dell's supply chain model. Kodak had several resources by which to gather this information: personal accounts from Kodak employees who had previously worked at Dell, a presentation on Dell's Supplier Logistics Center,<sup>52</sup> and a supplier agreement between Kodak and Dell.<sup>53</sup> Several aspects of Dell's hub model were identified and endorsed as desirable attributes:

1. Dell selected the third-party hub company with which its suppliers were required to work.
2. Dell specified a required inventory level that must be maintained in the hub and was not responsible for monitoring or maintaining these inventory levels.

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<sup>52</sup> Source: Magin, Cheri and Jim Yates. "The Dell Model for Home Printing Systems Operations & Supply Chain." Presentation.

<sup>53</sup> Source: Yates, Jim. Personal interview.

3. Dell's suppliers were responsible for all costs associated with the hub and for establishing and maintaining a working relationship with the third-party hub.
4. Dell took ownership of the goods when they were received on Dell's dock; there was no aging clause.

Dell was able to enforce this hub model with the majority of its suppliers because it was a large-volume customer to most of its suppliers and, thus, had the influence to demand such conditions. Companies such as Intel, however, who were not as dependent upon Dell's business, chose to not abide by this model. As illustrated by this point, then, Kodak may not have enough buyer power over some of its suppliers to demand that such a model be enforced.

Coupled with the above requirements for operating a hub would be daily pickups from the hub. Kodak's intention is to incorporate the hub into inbound milk runs or to set up daily deliveries from the hub to the points of use. This practice would effectively replicate the fast flow model for items as they leave the hub. Kodak would assume ownership of the items upon pickup, so that items used on a daily basis should never exceed more than 1-2 days of supply under Kodak's ownership. B and C items that are used less frequently would be included in the same inbound milk runs but, for economic reasons, most likely not on a daily basis; this would result in several days or a week's supply of these items at the point of use.

#### **4.1.7 Store**

Store is the terminology applied to a warehousing strategy where inventory is physically housed at a Kodak-operated location. This solution would be preferable to a hub solution if Kodak can house, handle, and manage a specific material cheaper than a third-party hub. Also in some cases, Kodak may not have the buyer power in the supply chain to require a supplier to put goods into a hub. In which case, Kodak would have to opt for the store option at its location. It is important to note that any material owned by Kodak shall be handled, managed, and stored by Kodak resources. In the past, situations had arisen in which Kodak owned materials stored in a third-party hub; this practice is against Kodak's intent as it moves forward in standardizing its inbound supply chain.

#### **4.1.8 Foreign Trade Zones**

Foreign trade zones are considered to be a subset of a hub or store strategy. Generally, items that are coming from a foreign location have long transportation lead times and shipment volumes and frequencies that are not matched to production usage. As a result, these items are best suited for a hub or store model.

Some of the direct financial benefits of a foreign trade zone include duty deferrals, duty elimination, inverted tariff savings, reduction of merchandise processing fees, and tax exemptions. Inverted tariff savings occur when imported parts are dutiable at higher rates than the finished product into which they are incorporated.<sup>54</sup> Inverted tariffs and other duty savings

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<sup>54</sup> Source: Export America website, <[http://www.export.gov/exportamerica/TechnicalAdvice/ta\\_foreign\\_trade\\_zones\\_0203.html](http://www.export.gov/exportamerica/TechnicalAdvice/ta_foreign_trade_zones_0203.html)>.

will be discussed further in section 5.4.3. Other benefits include the theft deterrent nature of an FTZ due to customs security requirements and federal criminal sanctions, quota avoidance, and the fact that there is no time limit on how long goods can be kept in an FTZ.<sup>54</sup>

While the benefits of an FTZ can be great, they do not come easily. Each new building or site must request authorization and be inspected and authorized through an application process with the Foreign Trade Zone Board. In addition, there are strict security and operating requirements that must be initiated and maintained in an activated FTZ. Import Services is located within Kodak's Global Manufacturing & Logistics organization and is the group that has expertise and responsibility for managing these steps. At the time of this thesis, some buildings at Kodak Park in Rochester, NY were activated as foreign-trade zones and Kodak had pending applications to activate or expand five of its sites.<sup>55</sup>

Once a site is operating as a foreign trade zone with the appropriate information systems, personnel, and operating procedures, there is virtually no limit to the number of imports going into an FTZ other than the physical capacity of the site. As a result, the limiting and important factor for effectively implementing an FTZ strategy is to get all of the sites activated where imported products may be distributed, stored, and/or manufactured. Additionally, there are limiting factors for getting a site activated; these include trained, responsible personnel to manage the FTZ sites, information systems that will properly track the status of FTZ goods, and a building or site with physical characteristics that will not compromise security.

#### **4.1.9 Vendor-Managed Inventory (VMI)**

Kodak's definition of vendor-managed inventory does not deviate from or append the standard APICS definition stated in Chapter 2 where "the supplier has access to the customer's inventory and is responsible for maintaining the inventory level required by the customer." The application of VMI at Kodak was common among commodity or commodity-like products such as nuts and bolts, liquid nitrogen, and bulk products such as PET pellets. Using VMI can be advantageous because it gives the supplier greater visibility into Kodak's demand and helps the supplier to better plan its production and restocking schedule. For Kodak, it eliminates the resources necessary to manage inventory levels and submit orders; however, there may be some additional work required to set up systems to communicate forecasts and inventory information to the supplier. This requires that the supplier has the appropriate information systems and resources to get this information, and also the capability and expertise necessary to effectively manage the inventory levels. And finally, some level of trust in the supplier and its ability to manage inventory levels would be required for Kodak to pursue this type of logistics solution.

## **4.2 CLASSIFYING AND STANDARDIZING**

One of the most important pieces of this thesis work was the organization and classification of the available logistics solutions. This process involved the following series of insights and results: (1) recognizing the need for organization, (2) sorting and characterizing the various solutions, and (3) classifying the solutions into categories.

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<sup>55</sup> Source:Dellefave, Maria. "Eastman Kodak Foreign Trade Zone." Presentation given at Eastman Kodak Company.

The first step involved recognizing that some of these strategies were compatible with each other, while some were mutually exclusive. For example, while an item could be in a foreign trade zone on consignment, it could not be both in a hub and under a direct ship strategy. On the other hand, an item under vendor-managed inventory could be fast flowed, direct shipped, or sent through a hub.

In order to understand why this lack of parallelism between models existed, the next step was to break down the operation of each logistics solution to understand the criteria accounted for by each. For example, fast flow specified how a material was ordered and delivered to Kodak, but not the point at which ownership transferred. VMI specified the party responsible for managing inventory levels and creating orders, but not the transportation strategy or point at which ownership transferred.

The final step involved the grouping of similar and mutually exclusive methods into categories that described the material, information, and financial flows. The following three categories were identified and each logistics method was classified into one of the three complimentary categories: the material flow of Warehousing & Transportation, the financial flow of Inventory Ownership, and the information flow of Inventory Management. As a result, a total logistics solution would consist of one selection from each of these categories.

#### **4.2.1 Warehousing & Transportation Strategy**

The warehousing and transportation portion of the supply chain strategy encompasses the facilities, vehicles, and people involved in moving material from the point of manufacture to the point of consumption. A warehousing and logistics strategy should specify the transportation mode, the party responsible for transportation scheduling and payment, and the locations where goods will be picked up, stored if necessary, and delivered. The scope of this category is quite broad when considering the many different transportation and warehousing solutions to choose from and the vast number of geographical locations that could be involved. Not too surprisingly then, most of the logistics models discussed fall under this category: fast flow, foreign trade zone, hub, store, and direct shipments.

#### **4.2.2 Inventory Ownership Strategy**

Based upon the legal implications involved with financial activities, the inventory ownership portion of the supply chain is perhaps the most complex. An inventory ownership strategy should define the point at which ownership and risk of loss occurs. The multitude of points along the supply chain at which ownership transfer could occur further complicates this decision. This point could be defined by an event such as goods consumption, receipt, or pickup, or by a time frame that specifies transfer of ownership after a certain number of days. Consignment falls under this category; however, given that it is a specific and limited strategy, extended terms and standard terms terminology have been identified and defined to complete the spectrum of inventory ownership options.

#### **4.2.3 Inventory Management Strategy**

The inventory management piece of the supply chain involves a simpler, yet very important, decision. An inventory management strategy is intended to specify the party responsible for

setting the minimum inventory level or reorder point and subsequently monitoring and maintaining these inventory levels. Essentially, the party responsible for inventory management initiates an order or shipment based on inventory levels, without the consumer necessarily having to place an order. The potential strategies available for inventory management include vendor-managed inventory, Kodak-managed inventory, or third party-managed inventory.

## **4.3 OUTCOME**

### **4.3.1 Potential Solutions**

The strategies within a specific classification are mutually exclusive, for example, fast flow and direct shipment under the Warehousing & Transportation category; however, they are complimentary between classifications. The only exception to this rule involves foreign trade zones, which are a subset of a hub or store strategy. As a result, each item or supplier should employ a strategy comprising three selections, one each from the Warehousing & Transportation, Inventory Ownership, and Inventory Management groups. One example of a potential strategy would be an item that is put in a hub, is on consignment, and its inventory is vendor managed. Based upon the available options and combinations, this potentially creates 72 different supply chain strategies!

Fortunately, of these 72 combinations, there were many that were not practical or would not be used under common sense judgment. In addition, it was desirable to limit the number of options available for people to use in order to simplify the selection, implementation, and monitoring of Kodak's inbound logistics. One of the problems with the existing state of Kodak's inbound supply chain was that the large variety of logistics solutions and implementations that were in place, and the lack of coordination, led to higher transportation and inventory costs. This restrictive approach would also limit the number of resources, such as information systems and procedures, which would have to be updated and maintained in order to support all of the possible logistics solutions. As a result, it was desirable to identify a limited subset of possible logistics solutions and create boundaries around these solutions to guide the selection and implementation process. Several assertions were made in order to reduce the potential number of solutions down to a manageable set of practical solutions.

1. ***Consignment and extended term agreements should not be implemented with the fast flow, direct shipment, or hub strategies.*** This was the most significant decision. The reason for this decision was based on the fact that the fast flow and direct shipment strategies involve daily or more frequent deliveries to the points of use. As a result, inventories of items under these models should be no more than 2-3 days of inventory when accounting for safety stock. Inventories at such low levels do not warrant the effort and resources necessary to negotiate and maintain a consignment or extended terms agreement. Similarly, the hub strategy is intended to be incorporated with daily deliveries to the point of use, therefore, it was decided that goods in a hub should not be on consignment or extended terms. The hub, as envisioned by Kodak's Global Logistics group, should only hold material owned by the supplier and at the cost and responsibility of the supplier. In addition, since the hub will be coupled with daily pickup of materials for delivery, once again, inventory levels at Kodak should not exceed 2-3 days and, therefore, do not warrant the cost of implementing extended terms or consignment.

2. ***A foreign trade zone is not a stand-alone solution; it will be an overlay to the Warehousing & Transportation category.*** Solutions will not be classified as “FTZ” or “non-FTZ.” A foreign trade zone strategy must be combined with, and is transparent to, a hub, store, fast flow, or direct shipment strategy. Due to the attributes of goods coming from a foreign country, these items best fit into a hub or store model. As a result, an FTZ is not an option for goods that are fast flowed or direct shipped. Although there may be some anomalies to this statement, such as goods on fast flow from Toronto, Canada to Rochester, NY, this anomaly is attributed to the proximity of Rochester, NY to Canada and would not happen in most of Kodak’s location. Also, this scenario occurs for only a handful of items.
  
3. ***The Inventory Management strategy will not be a decision factor, and vendor-managed inventory will not be part of any supported logistics solutions.*** The primary reason for this decision was the lack of existing cases where VMI was implemented and the potential future cases where it may make sense. While the existing VMI items seemed to fit with and were operating well this model, it did not seem to make sense to put new items into this model. Furthermore, other than the third party-managed materials inside hubs, there were no examples of other third party-managed models. As a result, third party-managed inventory was eliminated as a decision option because it was inherently part of the hub operating model.

Figure 11 shows the results of these three major decisions and the six possible solutions that resulted. Note that while “Management Strategy” is included in the diagram for illustration purposes, from this point on it will not be explicitly stated because it is implicitly part of the option to use or not use a hub.

Logistics & Transportation Strategy	FTZ-Strategy	Ownership Strategy	Management Strategy	Result #	Logistics & Transportation Strategy	FTZ-Strategy	Ownership Strategy	Management Strategy	Result #
<b>Fast Flow</b>		Consignment	Vendor-managed	1	<b>Hub</b> (FTZ / non-FTZ)		Consignment	Vendor-managed	37
			3rd-party-managed	2				3rd-party-managed	38
			Kodak-managed	3				Kodak-managed	39
	FTZ	Extended Terms	Vendor-managed	4		Vendor-managed	40		
			3rd-party-managed	5		3rd-party-managed	41		
			Kodak-managed	6		Kodak-managed	42		
		Standard Terms	Vendor-managed	7		Vendor-managed	43		
			3rd-party-managed	8		3rd-party-managed	44		
			Kodak-managed	9		Kodak-managed	45		
	non-FTZ	Consignment	Vendor-managed	10		Vendor-managed	46		
			3rd-party-managed	11		3rd-party-managed	47		
			Kodak-managed	12		Kodak-managed	48		
		Extended Terms	Vendor-managed	13		Vendor-managed	49		
			3rd-party-managed	14		3rd-party-managed	50		
			Kodak-managed	15		Kodak-managed	51		
	Standard Terms	Vendor-managed	16	Vendor-managed		52			
		3rd-party-managed	17	3rd-party-managed		*53*			
		Kodak-managed	*18*	Kodak-managed		54			
<b>Direct Ship</b>	Consignment	Vendor-managed	19	Vendor-managed	55				
		3rd-party-managed	20	3rd-party-managed	56				
		Kodak-managed	21	Kodak-managed	57				
	FTZ	Extended Terms	Vendor-managed	22	Vendor-managed	58			
			3rd-party-managed	23	3rd-party-managed	59			
			Kodak-managed	24	Kodak-managed	60			
		Standard Terms	Vendor-managed	25	Vendor-managed	61			
			3rd-party-managed	26	3rd-party-managed	62			
			Kodak-managed	27	Kodak-managed	63			
	non-FTZ	Consignment	Vendor-managed	28	Vendor-managed	64			
			3rd-party-managed	29	3rd-party-managed	65			
			Kodak-managed	30	Kodak-managed	*66*			
Extended Terms		Vendor-managed	31	Vendor-managed	67				
		3rd-party-managed	32	3rd-party-managed	68				
		Kodak-managed	33	Kodak-managed	*69*				
Standard Terms	Vendor-managed	34	Vendor-managed	70					
	3rd-party-managed	35	3rd-party-managed	71					
	Kodak-managed	*36*	Kodak-managed	*72*					

Figure 11. Constraints leading to the standard set of endorsed logistics solutions.

The decision tree and set of logistics solutions went through many iterations to get to the end result. While the three stipulations that are listed encompass the decisions that led to the end result, there were many assumptions that were considered and were ruled out along the way. For example, when evaluating the inventory management strategy, at first only vendor-managed and Kodak-managed scenarios were considered; later on the scope expanded to include third party-managed inventories. Also, throughout most of this research work, the terminology hub and store were used interchangeably. The recognition that they actually represented two different strategies and that Kodak needed further delineation in its warehousing solution set, led to the differentiation in terminology. Finally, in the inventory ownership space, initially contracts were only classified as consignment or non-consignment. As the project investigation ensued, however, we identified other types of contracts and as a result, the extended terms and standard terms options were identified and defined.

### 4.3.2 Endorsed Solutions

As a result of this reduction process, six possible solutions have been identified that will be standardized and supported by Kodak. In order to make it easier to evaluate current inbound logistics practices against these six models and to aid in the selection and implementation of an endorsed solution, differentiating criteria were defined for each model and are listed in Table 1.

Table 1. Defining characteristics of inbound logistics solution set.

Warehousing & Transportation	Ownership Terms	Inventory Location	Ownership @ Point of Use	Inventory Management Responsibility	Point of Title Transfer	Visibility in Kodak's Planning System
Direct Ship	Standard Terms	N/A	Kodak	Kodak	supplier's dock	after receipt
Fast Flow	Standard Terms	N/A	Kodak	Kodak	supplier's dock	after receipt
Hub	Standard Terms	3rd party	Kodak	3rd-party	hub's dock	after receipt
Store	Consignment	Kodak	Supplier	not specified*	when pulled @ point of use	prior to receipt
	Extended Terms	Kodak	Supplier / Kodak	not specified*	determined in contract	after receipt
	Standard Terms	Kodak	Kodak	not specified*	supplier's dock	after receipt

\* Could be Kodak-managed, supplier-managed, or 3rd-party managed

There is not a one-size-fits-all solution; likewise, there is not a six-models-fits-all solution. These six models are intended to cover approximately 99% of all of Kodak's existing inbound materials and suppliers; however it is recognized that there will be some outliers. Vendor-managed inventory is one of these. Another example occurred with a supplier that was on direct ship and consignment, moved to a fast flow model, but remained on consignment. The supplier was not willing to give Kodak a price break to go off consignment to a standard terms agreement because there had not been a price increase when the consignment contract was implemented. As a result this item remained under a fast flow/consignment model. Additional examples will be evaluated in Chapter 6. The bottom line is that the principal intention of this process is to implement a model that makes sense and provides the lowest landed material cost for the company.

### 4.4 SUMMARY

Kodak's inbound logistics strategies can be classified into three categories: Warehousing & Transportation Strategy, Inventory Ownership Strategy, and Inventory Management Strategy. The logistics strategies within each of these categories are mutually exclusive, and a complete logistics solution should incorporate of one method from each of these categories. In order to reduce the potential logistics solutions to a manageable number, several guidelines were developed: (1) consignment and extended terms should not be implemented with fast flow, direct shipment, or hub strategies, (2) a foreign trade zone is not a stand-alone strategy; it must be combined with another Warehousing & Transportation method, and (3) Inventory Management will not be a deciding factor in developing a complete logistics solution.



## **CHAPTER 5 DECISION TOOL**

Once the state of Kodak's inbound logistics solutions had been classified, defined, and bounded, the next step was to develop a process that would standardize the selection of one of these models. The all-encompassing goal of the decision tool was twofold: 1. Create a process that would aid in selecting a logistics solution with the lowest possible landed cost for a material, and 2. Make this process easy to understand and follow.

### **5.1 PURPOSE AND SCOPE**

During the interview process, we observed that decisions often were made without a full understanding of all of the logistics solutions available. Also, people tended to implement one common solution across all of the materials for which they were responsible. These actions did not always result in the most efficient or cost-effective logistics implementations. As a result, it became important to provide a tool to help people across the corporation make educated, objective logistics decisions in a standard manner at the lowest levels of the organization.

Furthermore, the intent in creating this process was to make it easy to understand and use with very little direction or explanation and to make the materials and resources readily available to all users. In order to accomplish this goal, several supplemental documents were created in addition to the decision tree itself. A preface to the decision tree was created to introduce the process, purpose, and scope of the decision tree to users. The preface is included in Appendix A. In addition, a supplemental worksheet, set of instructions, and calculation tools were developed to lead the user through the decision tree process in a straightforward, step-by-step manner. These supplemental materials are discussed in detail in section 5.4 and are included in the appendices for reference.

The next task was to define the decision process with the appropriate scope in mind. We decided to make the scope as large and encompassing as possible in order to draw upon transportation synergies from inbound items moving from all possible geographic locations to all of Kodak's sites worldwide. As a result, the decision tool was created to include everything from raw materials coming from suppliers and distribution centers to finished goods coming to Kodak from OEMs. Also, the tool was intended to be generic enough that it could be applied not only at Kodak Park in Rochester, NY but also to Kodak's suppliers and sites in other parts of the U.S., Mexico, Europe, Brazil, and Asia.

### **5.2 DECISION TREE**

Similar to the strategy used to classify and define the set of standard logistics solutions, it was necessary to understand the way logistics decisions were made, the criteria that were important in making these decisions, and the financial decisions that were required. The decision tree in Figure 12 shows the flow of the decision process and the paths that lead to selecting or ruling out a specific solution. The decision tree worksheet, which will be discussed in section 5.4.1, provides structure and direction to help work through the decision tree. Noted below are several structural features of the decision tree that are important to the sequence of the decisions and outcomes as they appear in the tree.

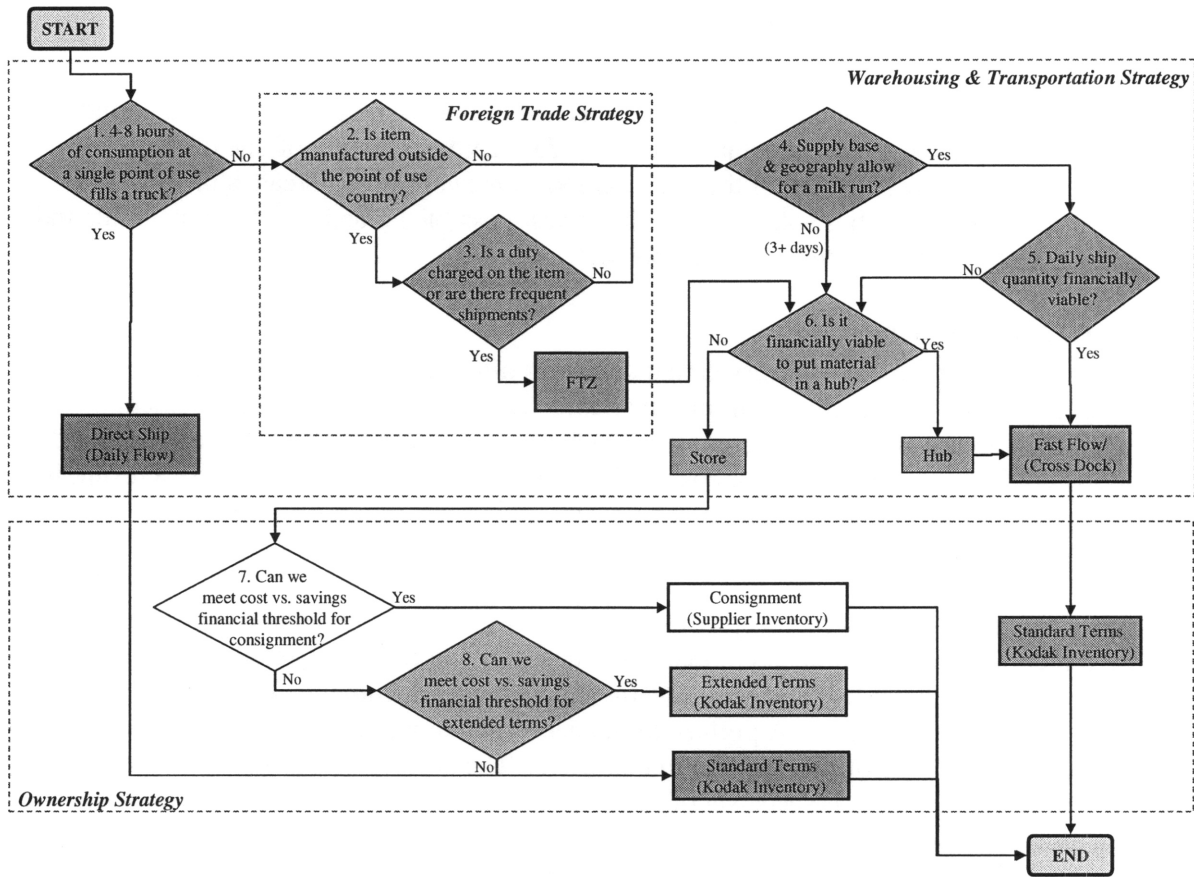


Figure 12. Inbound logistics decision tree.

- The order of the Warehousing & Transportation and Ownership Strategy decisions may be counterintuitive to a user in purchasing.*** The Warehousing & Transportation portion of the logistics strategy decision is the first to be made, while the Inventory Ownership Strategy is a follow on to that decision and is somewhat dependent upon the Warehousing & Transportation strategy. Intuitively, this is not the way that a buyer or commodity manager in purchasing would approach this decision. Generally when negotiating a contract, the first thought is given to the inventory ownership and at what point this ownership transfers in the supply chain. For the purpose of this process, however, the inventory ownership solution depends upon the warehousing & transportation and if the ownership decision were to be made first, it may not result in the best solution for the company. For example, if a material is directly shipped or fast flowed, the logical, cost-effective follow-on is to not put that material on consignment. If the consignment decision were made first without giving thought to how the material would be shipped to Kodak, then, for example, a material could end up on fast flow with consignment; this would most likely be cost-prohibitive to Kodak and the Ownership Strategy decision may have to be re-evaluated. While putting the Warehousing & Transportation decision first may seem to be the most sensible approach to structuring the decision tree, it may require some organizational changes and transformations in thought processes for purchasing personnel.

- ***The Warehousing & Transportation and Ownership Strategies depend upon each other in determining the lowest delivered cost for the material.*** The decision tree depicts the financial decision to put a material in a hub or Kodak storage as a separate financial decision from the Inventory Ownership Strategy when, in fact, they may be evaluated at the same time. For example, if the decision to put a material into a hub or Kodak storage is being considered, not only is the cost to store that material a factor but also who will own that material while it is being stored. As a result, the financial model, which will be discussed in section 5.4.7, takes into account all of these costs associated with warehousing & transportation and inventory ownership.
- ***The order of the outcomes in the decision tree flow is not reflective of the significance or popularity of the logistics solutions.*** One might notice that direct shipment is the first potential outcome of the tree; however, we estimate that only 5% or less of all of Kodak's materials would fall under this strategy. Likewise, fast flow, which is one of the most desirable solutions and one which Kodak is trying to utilize more, is on the far right-hand side of the tree, after the decisions that could lead to a direct shipment, hub, or store strategy. The reasoning for this structure was for functionality and ease of use rather than to visually indicate or steer people to the most desirable logistics solutions. As said before, the purpose of this tree is to facilitate an objective decision-making process. Also, for example, it does not make sense to take an item that is a prime candidate for direct shipments, which means that it is most likely coming from a nearby location and not imported, and question whether it should be in an FTZ. Furthermore, if the fast flow decision were to come first, it would be harder to prevent direct ship candidates from ending up in fast flow, which would create unnecessary material movement at the cross-dock by unloading and reloading full truckload shipments.

### **5.2.1 Decision Factors**

The decision factors that are critical to selecting the most appropriate logistics solution were derived from the interviews done in the investigation phase. The subject matter experts and people with expertise in applying each method provided these insights. As a result, each logistics solution has unique decision factors that are captured in the decision tree and reviewed in detail below.

1. *Does 4-8 hours of consumption at a single point of use fill a truck?* This question is aimed at creating transportation efficiencies by filling trucks when possible without creating excess put-away costs or the need for inventory storage space at the manufacturing site.
2. *Is the item manufactured outside the point-of-use country?* This condition is necessary to determine if import duties or fees are paid on an item being imported into the country where the item will be manufactured or sold. The statement is broad to account for situations where an item is imported, but not imported by Kodak, thus resulting in an overlooked foreign trade zone savings opportunity. For example, an item may be manufactured in a foreign country and then imported by the company's domestic subsidiary or by a third party distributor. Items in these situations may easily fall outside of Kodak's "import radar."

3. *Is a duty charged on the item, or are there frequent shipments?* The purpose of this inquiry is to determine the potential savings of putting an item into an FTZ. If an FTZ exists at a manufacturing or storage location that is not at capacity, determining this savings is not as critical. If an FTZ does not exist or it is at capacity, this evaluation helps to build a business case for activating an FTZ or making space for an item in a current FTZ.

4. *Does the supply base and geography allow for a milk run?* This inquisition helps to determine if the location from where material is being shipped fits into a current milk run or is in an area with enough suppliers to build a new milk run. This analysis also helps to identify geographic candidates for milk runs that are feasible from a proximity perspective but are limited by supply density in the area.

5. *Is a daily ship quantity financially viable?* Once an item is geographically qualified for a milk run, the financial feasibility of shipping daily quantities is evaluated. Most suppliers are willing to ship regularly scheduled, daily, level quantities of material, and thus an increase in piece price is not expected. Sometimes the material cannot physically or cost-effectively be broken down into daily quantities.

6. *Is it financially viable to put material into a hub?* Once the direct shipment and fast flow options have been eliminated, this question evaluates the financial tradeoffs to put a material into a third-party hub or store it at Kodak. This decision is related to criteria 7 & 8, above, because the decision to hub a material is partially dependent upon the option to store a material on consignment or extended terms.

7. *Can we meet the cost vs. savings financial threshold for consignment?* The intent of this analysis is to evaluate the cost of consignment as compared to the estimated savings generated through the elimination of carrying, hub, and insurance costs.

8. *Can we meet the cost vs. savings financial threshold for extended terms?* This question duplicates that of question 7 but in the case where a consignment contract cannot be established, and an aging clause or other terms are required to reach an agreement.

### **5.2.2 Decision Tree Outcomes**

The outcomes of the decision tree make up the standard set of logistics solutions. The solution recommended by the decision tree should be the one that results in the lowest landed cost for Eastman Kodak Company. Based upon the principles of lean theory and the goal to make the inbound supply chain as efficient as possible, the solutions have been ranked in order of desirability. Direct shipment and fast flow are the most desirable solutions since they are the best implementation of continuous flow and just-in-time techniques. A hub strategy is preferable over a store solution because it reduces Kodak's liability and responsibility for inventories. And finally, in order to reduce the financial burden of inventories, consignment is preferred over extended terms, which is preferred over standard terms. Figure 14 illustrates this hierarchy, which is merely a ranking of preferences in an ideal situation without a detailed financial evaluation; ultimately the final delivered piece cost will drive the decision.

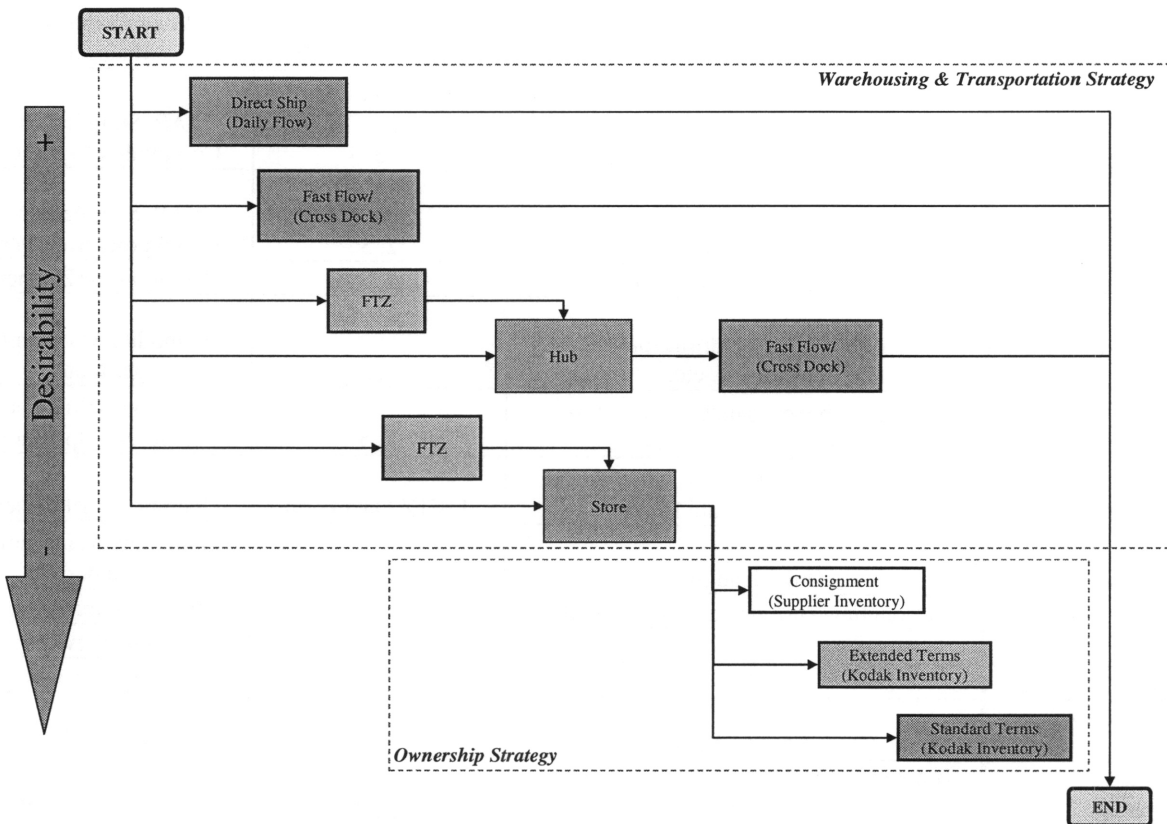


Figure 13. Preferential flow chart for logistics solutions.

### 5.2.3 Required Data

Based upon these decision criteria, we defined and compiled a set of data that was necessary to complete the decision tree. While all points in this data set may not be applicable to every material or required for every item that goes through the decision tree, the complete data set will give a person all of the information he needs to make an informed decision approximately 95% of the time. The required data is listed below and includes the specific information or format that is required, the section or question of the decision tree where it is used, and the source(s) from which it may be obtained.

Table 2. Required data for the decision tree process.

Required Data	Description	Where Used (# corresponds to decision tree question #)	Where to Find Data
Item #	N/A if evaluating similar items in aggregate (i.e., all colors of vinyl or all just-in-time drum chemicals coming from the same distributor)	Decision Tree Worksheet Header	SAP
Item Description	--	Decision Tree Worksheet Header	SAP

<b>Supplier Name</b>	--	Decision Tree Worksheet Header	SAP or Commodity Manager
<b>Supplier Ship From Address</b>	Minimum of city, state/province, & country	Decision Tree Worksheet Header, 2, 3, 4	SAP, Supplier, or Commodity Manager
<b>Manufacturing Origin/Location</b>	Minimum of city, state/province, & country	Decision Tree Worksheet Header, 2, 3	SAP, Supplier, or Commodity Manager
<b>Daily Usage</b>	Pieces, kg, tons, pallets, etc.	1, 5	Operations or Planner
<b>Pallet or Container Quantity</b>	# of boxes/pallet, drums/pallet, pieces/box, etc.	1, 5	Commodity Manager or Operations
<b>Shipment Quantity</b>	# of drums, boxes, pallets, pieces, boxes, containers, trailers, railcars, etc.	1, 5	Commodity Manger, Logistics, or Operations
<b>Points of Use</b>	Building #s at Kodak Park, other Kodak sites, or city & state location	1, FTZ Data Form	Operations or Planner
<b>Lead time</b>	Order lead time	5, 6, 7, 8	Commodity Manager or Planner
<b>Unit Value</b>	In accounting, currency used at point of use	3, 5, 6, 7, 8	SAP or Purchasing
<b>Duty on Raw</b>	%	3	Import Services
<b>Duty on Finished</b>	%	3	Import Services
<b>Fin Good for Export</b>	% exported (if Yes) or No	3	Operations or Planner
<b>Shipment Frequency</b>	If not constant, average frequency over a year	1, 5	SAP or Purchasing
<b>Average days of inventory</b>	Averaged over a year	6, 7, 8	CMIS Browser or Operations
<b>Value of Inventory on Hand</b>	In accounting currency used at point of use	6, 7, 8	CMIS Browser or Operations
<b>Annual Supplier Spend/Purchases</b>	In accounting currency used at point of use	6, 7, 8	Watson Database, CMIS Browser, or Purchasing

Additional data tables for the foreign trade zone and milk run decisions are included in sections 5.4.2 and 5.4.6, respectively. These data tables are subsets of the data required by the decision tree process with a few additional data points that may be occasionally required. While all of the data is straightforward and objective information, the knowledge does not reside in one location or with one person, and the data may not be readily available or transparent in Kodak's current operations. One example of this lack of transparency occurs with the "manufacturing origin/location" datum point, in the case that a material is shipped from a distributor or warehouse location that is not the manufacturing location. In another instance, it may require several steps and information sources to determine the finished product is for a raw material and how much of the finished product is exported for foreign trade zone duty purposes.

## 5.3 SUPPLEMENTAL MATERIALS

### 5.3.1 Worksheet

We created the decision tree worksheet to provide guidance in working through the details of the decision tree and also to document the decisions and outcomes of the decision process for a particular material or set of materials. The decision tree worksheet is ordered in the same way as the decision tree, asks the same questions, and leads to documentation of the outcomes specified by the decision tree. The decision tree worksheet is supplemented by a detailed instruction sheet for each question, so that a new or less-experienced user can work through the process relatively easily by using the worksheet and instructions. The decision tree refers to other supplemental materials that are separate spreadsheets for making FTZ decisions and financial decisions regarding fast flow daily pickups, hubs, consignment, and extended terms. A completed decision tree worksheet example is included in Appendix C.

### 5.3.2 Foreign Trade Zone Data Form

The Foreign Trade Zone Data Form is designed to capture all of the information needed by Import Services to make an informed decision as to whether an item should go into an FTZ, determine the potential savings of doing so, and evaluate the implementation and activation requirements. For example, an item could be a perfect candidate for a foreign trade zone if it has a high duty rate or its finished product is exported; however, the manufacturing site may not be classified as an FTZ or the item may be cleared by the supplier through customs into a non-FTZ location. Table 3 lists the data required by Import Services for the FTZ analysis, the purpose served by the data, and where the data may be found.

Table 3. Information required for the Foreign Trade Zone Data Form.

Required Data	Description	Purpose	Where to Find Data
<i>Item #</i>	N/A if evaluating similar items in aggregate (i.e., all colors of vinyl or all just-in-time drum chemicals coming from the same distributor)	Determining duty %	Buyer/Commodity manager or SAP
<i>Item Description</i>	--	Determining duty %	Buyer/Commodity manager or SAP
<i>Kodak Buyer</i>	Name of commodity manager or buyer	Information contact	Buyer/Commodity manager or SAP
<i>Country of Export</i>		Determining duty %	Buyer/Commodity manager
<i>Country of Manufacture</i>	Location where item was manufactured regardless of exporting country	Determining duty %	Buyer/Commodity manager
<i>Duty (if known)</i>	%	Calculating annual duty payouts	Import services
<i>Unit Value</i>	In U.S. dollars	Calculating annual duty payouts	Buyer/Commodity manager or SAP
<i>Annual Spend</i>	In U.S. dollars	Calculating annual duty payouts	Buyer/Commodity manager, SAP, or CMIS Browser

<i>Shipment Frequency</i>	If not constant, average frequency over a year	Calculating annual processing fee charges	Buyer/Commodity manager or SAP
<i>Average Invoice Value</i>	In U.S. dollars; if not constant, average over all invoices	Calculating annual processing fee charges	Buyer/Commodity manager or SAP
<i>Consigned?</i>	Yes or No	Determining feasibility of implementation	Buyer/Commodity manager or SAP
<i>Finished Good item # or description</i>	The item # or description of product that raw materials goes into	Calculating inverted tariff savings	Buyer/Commodity manager, Planner, or Operations
<i>Finished Good Duty (if known)</i>	%	Calculating inverted tariff savings	Import services
<i>% of Finished Good exported</i>	%	Calculating duty savings	Buyer/Commodity manager, Planner, or Operations
<i>Mfg. System</i>	SAP, AMAPS, 4th Shift, etc.	Determining feasibility of implementation	Planner or Operations
<i>Process Flow for Inventory &amp; Mfg.</i>	All plants/buildings/locations that material moves through, is stored or processed in	Determining feasibility of implementation	Planner or Operations
<i>Current Broker</i>	Kodak, Name of supplier of 3rd party (if applicable)	Implementation feasibility & calculating broker's fee savings	Buyer/Commodity manager

### 5.3.3 Foreign Trade Zone Financial Model

The foreign trade zone financial model can be used in parallel with the decision tree to evaluate the potential savings of putting an item in a foreign trade zone. The model is broken down into three major sections to perform the potential savings calculations: duty elimination or postponement, duty reduction through inverted tariffs, and merchandise processing fee savings. These savings opportunities are explained below, and a sample FTZ savings calculation is included in Appendix F.

#### Duty Elimination or Postponement

The first calculation accounts for two different situations in which the duty percentage on a good does not change but duty savings can still be realized. One scenario occurs when an item is being imported, processed or packaged in a foreign trade zone and some or all of the finished good is exported. In this situation, duties do not have to be paid on the exported product if it was processed in an FTZ-classified location, and hence, the item never actually entered the customs territory of the U.S. The opportunity presented by this scenario provides an incentive for bringing or keeping industrial or manufacturing jobs in the U.S. The second savings opportunity is duty deferral. This is a less significant opportunity because the duty payment is still due, but at a later date when the material is pulled from the FTZ location. As a result, Kodak gains a slight advantage by postponing the payment so it can free up cash in the short term and achieve some savings based upon the time value of money.



### Inverted Tariffs

The second major savings calculation relates to duty reductions through inverted tariffs. An inverted tariff may occur if an imported raw material is processed in an FTZ into a finished product that has a lower duty rate. The type of FTZ wherein Kodak would manufacture or process goods is called a subzone or a special purpose zone.<sup>56</sup> In this situation, the raw material is turned into finished goods before entering the U.S. customs territory; therefore, the raw material can be reclassified and charged the lower duty rate associated with the finished product of which it becomes a part. One of the most illustrious instances of an inverted tariff savings at Kodak occurred with one-time-use cameras. In this example, Kodak imported flash charger boards with an associated duty of 12%, manufactured them into one-time-use cameras in a Kodak foreign trade subzone, and withdrew the assembled camera at its duty rate of 0%.<sup>57</sup>

Foreign trade zones are not the only solution to recouping duty savings from exported dutiable goods and inverted tariff opportunities. U.S. customs has a duty drawback program that allows Kodak to potentially recuperate duty payments from products after they are exported, rejected, or destroyed. Unfortunately, this process is considered a privilege rather than a right; those who seek to qualify must comply with the pertinent laws and regulations that require the appropriate record keeping and the filing of a drawback claim.<sup>58</sup> In addition, there are various expirations for drawback claims, and ultimately, if the drawback is approved, it can take 2-5 years<sup>57</sup> to recuperate the savings, which is then, at most, only 99% of the original charges.<sup>58</sup>

### Merchandise Processing Fees

The final potential savings opportunity comes from consolidating merchandise processing fees (MPF). Merchandise processing fees are charged at 0.21% of the invoice value of the goods being imported, with a maximum charge of \$485 per entry.<sup>56</sup> If goods are not going into a foreign trade zone, an entry constitutes one invoiced shipment. If goods are going into an FTZ, then U.S. Customs allows for the consolidation of shipments into weekly, per-port entries. As a result, the maximum that one FTZ site would have to pay in merchandise processing fees is \$485/week to each port from which it receives goods.<sup>59</sup> With the volumes of chemicals being imported from overseas and the value of digital products coming to the U.S. from Asian OEMs, this can represent a huge savings for Kodak.

#### **5.3.4 Shipment Frequency Financial Model**

I developed the Shipment Frequency Financial Model to evaluate the change in total delivered cost for a material when varying the shipment frequency. The two competing cost factors were the potential piece price increase for more frequent shipments versus the cost of capital saved by carrying less inventory. The model was initially developed for evaluating fast flow opportunities. It was recognized that daily pickups from the supplier could result in a piece price increase, while at the same time there was an expected transportation savings and inventory holding cost reduction. The transportation savings was anticipated because generally Kodak can get a better transportation rate than its suppliers and transportation synergies were expected to

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<sup>56</sup> Source: Dellefave, Maria. "Eastman Kodak Foreign Trade Zone." Presentation given at Eastman Kodak Company

<sup>57</sup> Source: Nespeca, Thomas. Personal interview.

<sup>58</sup> Source: Dye, Andy. "Duty Drawback Overview." Presentation given at Eastman Kodak Company.

<sup>59</sup> Source: Dellefave, Maria. Personal interview.

create higher utilization and lower per pallet shipping costs. Beyond evaluating potential fast flow opportunities, this model proved to be useful in general warehousing situations where it was desirable to reduce inventories through more frequent shipments or to reduce shipping costs through less frequent deliveries. This model and an example of its utilization are included in Appendix G.

### **5.3.5 Milk Run Lane Database**

The Milk Run Lane Database is a compilation of the Kodak milk runs currently operating. Each lane is listed with the suppliers and the geography that are supported. By posting this database in an easily accessible location, it allows decision tree users to quickly evaluate the geographic feasibility of adding a material to an existing milk run. This, in turn, allows the user to further pursue the milk run/fast flow opportunity, obtain advice from a subject matter expert if unsure of the outcome, or move on in the decision tree process to another solution if a milk run is completely unlikely. A sample of what the Milk Run Lane Database is intended to look like is included in Appendix H. This initial database example only includes the suppliers, physical addresses, and sequence of stops on the milk run. Ideally, it would be expanded to include the utilization of the milk run by providing data on the average and maximum number of pallets on the current milk run versus the total available capacity on the truck. The intention is to post this file on Kodak's intranet so any Kodak employee can access a current version.

### **5.3.6 Milk Run Data Form**

Similar to the Foreign Trade Zone Data Form, the Milk Run Data Form is intended to collect and document the information necessary to determine the feasibility of incorporating an item or supplier into a new or existing milk run route. Although a representative from operations or purchasing may be able to use the Milk Run Lane Database and knowledge of the material to make an informed decision, ultimately, the decision to put a material on a milk run is controlled by the logistics organization. The Transportation Planning group within Kodak's logistics organization holds responsibility for identifying and setting up new milk run routes, managing the day-to-day milk run operations, and maintaining utilization, timing, and delivery metrics. Accurately collecting, documenting, and communicating the pertinent data to this group is critical to the continued growth and success of the fast flow operations.

At the time of this thesis work, the agreed upon submission process was to e-mail the Milk Run Data Form to the person responsible for coordinating milk runs. Ideally, information systems and resources would be developed to allow for a web-based electronic form submission and tracking process. The Milk Run Data Form with sample information is included in Appendix I. Following is a list of the pertinent information requested by the form, the purpose that this information serves, and where the information may be found.

Table 4. Information required by the Milk Run Data Form.

<b>Data</b>	<b>Description</b>	<b>Purpose</b>	<b>Where to Find Data</b>
<i>Item #</i>	N/A if evaluating similar items in aggregate (i.e., all colors of vinyl or all just-in-time drum chemicals coming from the same distributor)	Identify item to be evaluated	SAP or Commodity Manager
<i>Item Description</i>	--	Identify item to be evaluated	SAP or Commodity Manager
<i>Supplier Name</i>	--	To set-up milk run and get additional information	SAP or Commodity Manager
<i>Supplier Ship From Location</i>	Minimum of city, state/province, & country or zip code	To set-up milk run lane	SAP, Commodity Manager, or Logistics
<i>Shipment Frequency</i>	If not constant, average frequency over a year	To verify feasibility of daily shipments	SAP, Operations, Planning, or Purchasing
<i>Shipment Quantity</i>	# of drums, boxes, pallets, pieces, boxes, containers, trailers, railcars, etc.	To verify feasibility of daily shipments	Commodity Manager, Planner, or Operations
<i>Pallet or Container Quantity</i>	# of boxes/pallet, drums/pallet, pieces/box, etc.	To verify feasibility of daily shipments	Commodity Manager, Planner, or Operations

### 5.3.7 Consignment and Extended Terms Financial Model

We developed the Consignment and Extended Terms Financial Model to financially evaluate the opportunity to place an item on a consignment contract. When the use of extended terms was identified and documented, the model expanded to include contracts in which an aging clause existed as well; however for simplicity, the model may sometimes be referred to as “the consignment model.” The idea for this model stemmed from an existing model that had been developed within Kodak to evaluate air freight decisions. The consignment model was Kodak’s first attempt at simplifying and quantifying inventory ownership decisions and putting this decision into the hands of the decision tree user. The purpose of this model is to provide a financial guideline to users for items that are clear candidates for or against consignment or extended terms contracts. It is envisioned, however, that a gray area of uncertainty will exist in which further investigation and consultation with Kodak’s finance department will be necessary. During the course of this thesis work, based on the situations that were encountered, it was estimated that this area of uncertainty might occur approximately 10% of the time. This is simply our best guess; there is no data to support this figure.

The model can be used in two settings: to estimate prices and upon quotation of prices. If Kodak is considering multiple scenarios or negotiating a deal, it can use the model to estimate the price that should be expected from the vendor or that would be acceptable to Kodak in each case. On the other hand, if the vendor has already quoted prices for various scenarios, Kodak can evaluate which proposal provides the most value or benefit to the corporation. Samples of these two consignment model variations, including inputs and calculations, are included in Appendix J. The details of the decision process and the factors that go into making this decision are discussed below.

Benchmarking Kodak’s existing consignment contracts for digital cameras, and the negotiations that resulted in those contracts, was the basis for the financial model referred to in the decision tree. The cost factors that were included in the model were the supplier’s cost to warehouse and insure, the supplier’s and Kodak’s cost of capital, transportation costs, and the average number of days of inventory in the supply chain during shipping and warehousing. These variables were used to break consignment down into each of its cost elements in order to allow for ease and flexibility in negotiating a consignment agreement. Once these factors were included in the decision tree consignment model, however, it became apparent that this model could evaluate more than just consignment opportunities. For example, by reducing the number of days in transit or in the warehouse, variations of extended terms contracts with a set number of days in the aging clause could be evaluated. In addition, by comparing differences in warehousing and insurance costs, a hub model could be assessed, and by varying the transportation and days in transit variables, a fast flow scenario could be evaluated.

The model does not incorporate the administrative costs required to set up and support a consignment contract, which includes inventory tracking, monthly consignment reports, and end-of-month inventory reconciliations. While we could not assign specific values to these costs through this research, the impact ranged anywhere from adding a person to a department’s headcount to a couple of hours a month of a buyer’s time to handle more than 10 items. In order to account for these intangible costs, several thresholds were added to the model. First, no item under \$100,000 of annual spend would be put through the model and be considered for consignment. We reasoned that for an item such as this, the potential annual savings that inventory reductions would yield would not justify the time and resources needed to implement consignment. The second threshold occurred once the data was input to the model. This threshold required that the savings must be some number greater than \$0 for the year in order to justify pursuing a consignment agreement. This number was not solidified during the course of this thesis work, but would be based upon the annual aggregate savings for a material or supplier consignment contract. An application of this threshold is depicted in Figure 14.

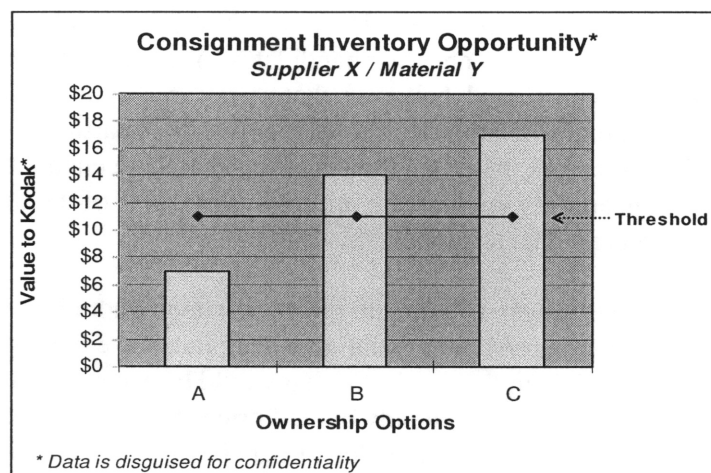


Figure 14. Financial threshold for evaluating consignment/extended terms options.

## **5.4 SUMMARY**

The goal of the decision tool is to provide a user-friendly tool that will aid in objectively selecting a logistics solution that will provide the lowest landed cost for Kodak. The decision tree is the main component of the decision tool and illustrates the questions that must be answered to determine the most appropriate logistics solutions. Supplemental materials to the decision tree include the decision tree worksheet and instructions, lists of data required to complete the decision process, financial models for decision-making, and data forms to communicate pertinent information. Several noteworthy features of the decision tree include the following: (1) the order of the Warehousing & Transportation and Inventory Ownership Strategy decisions in the decision tree may be counterintuitive to a user in Purchasing, (2) the Warehousing & Transportation and Inventory Ownership Strategies are dependent upon each other to achieve the lowest delivered cost, and (3) the order of the solutions in the decision tree is not reflective of the significance or popularity of these decisions. The preferred order of logistics solutions, from most desirable to least, is as follows: Direct Ship, Fast Flow, Hub in an FTZ, Hub, Store in an FTZ, Store, Consignment, Extended Terms, Standard Terms.

## **CHAPTER 6 DECISION TOOL VALIDATION**

Validation of the decision tool and the standard set of solutions was a three-step process. First, the decision tree and the potential outcomes were presented by Andy Clapper, Earl Chapman, and me to a cross-functional group of people in a one-day workshop. The intention of this activity was to preview the process, get feedback at the early stage of the decision tool development, and ultimately to get a sense of the usefulness and validity of the decision tool from stakeholders across the organization. Participants in the workshop included manager-level representatives from multiple Kodak sites and across many functional areas, including finance, purchasing, planning, logistics, and operations.

Afterward, we tested the decision tool itself across multiple business units and sites to validate the decision criteria, and the recommended logistic solutions against a broad range of existing inbound materials. These two validation steps led to continuous improvement of the decision tree and buy in of the decision tree process from the people involved in the validation process. More specifically, the decision tool developed into a robust process that could be applied to most of Kodak's inbound materials across the world and could account for many different scenarios with a standard, finite set of logistics solutions. Despite this, and not too surprisingly, some anomalies in Kodak's inbound logistics operations were discovered that are not accounted for by the recognized set of solutions. These will be discussed in section 6.2.5.

Finally, the six endorsed outcomes from the decision tree were compared against approximately 120 of Kodak's top annual spend inbound materials worldwide. This activity was useful for two reasons: First, it painted a picture of the extent to which each logistic solution was currently being used throughout the corporation, and second, it highlighted the variations between the terminology in use and the standard definitions set forth in this thesis work. Both of these outcomes provided a measure of the extent of the organizational change required to implement these logistics solutions.

### **6.1 DECISION TOOL WORKSHOP**

We started the decision tree workshop by presenting the current state of Kodak's inbound logistics operations, which included some of the terminology that was defined in Chapter 4. Next the envisioned future state of Kodak's inbound supply chain was presented in the form of the decision tree, the consignment financial model, and the standard set of solutions resulting from the decision tree. Throughout the day, input on current inbound logistics issues and feedback on the proposed future state were documented. At the end of the workshop, several consensus decisions resulted that validated the work that had been done up to that point, clarified the direction for moving forward, and verified the necessary buy-in and support of the decision tree process from the workshop participants. These were the main findings of the workshop:

1. A decision tree is appropriate as the mechanism for identifying and selecting alternative ways to manage inbound materials from suppliers to Kodak.

2. The decision tree will be used at the supplier level, not at the item level, so that multiple logistics solutions are not implemented across the array of materials that one vendor supplies to Kodak. The purpose of this tenet is to help reduce confusion.
3. The scope of the decision tree includes goods supplied by subcontractors. (Example: Digital cameras made by OEMs for Kodak.)

The workshop also identified some areas that needed development in order to support a robust decision tree process:

1. Standard definitions needed to be developed for all the logistics terminology with input and agreement from purchasing, logistics, and operations. (Chapter 4)
2. A governance strategy with roles and responsibilities would be necessary for the implementation and monitoring of the decision tree process. (Chapter 7)
3. Decisions were required to clarify the corporation's position on how hubs should be structured and used (section 4.1.6) and the extent to which consignment should be implemented (section 4.1.1).

Finally, several inbound materials examples were selected as good candidates for the decision tree validation. These items were identified for two reasons: they were 'problem' items for which it was difficult to determine and implement the best logistics solution or they were identified to test the validity of the decision factors for a specific logistics solution such as direct shipments. Due to the cross-functional nature of the workshop team and the various business units that were represented, a broad sample of materials and situations were identified.

## **6.2 VALIDATING SPECIFIC INBOUND MATERIAL EXAMPLES**

Based upon the materials identified in the workshop, several validation sessions were set up with multiple business units and sites at Kodak. Materials from health imaging equipment, health imaging media, synthetic chemicals, photo chemicals, graphic communications equipment, and Kodak Colorado Division (KCD) in Windsor, CO were reviewed. These materials provided a comprehensive set of examples that spanned all of the potential outcomes of the decision tree, tested the decision tree process, and in some cases, identified areas for improvement.

We found some materials to be under the proper logistics solution. In these situations, the decision tree simply validated the appropriateness of the existing method; while at the same time, the decision process itself was validated. Other materials were selected because they were high-profile items due to annual spend, purchase volumes, or high inventory levels. Some materials were new items that would be going out for bid or were under current contract negotiations, while others had been around for some time, and people were unsure if the proper logistics solution was in place or if there was a better solution.

Table 5 is a summary of some of the materials that were put through the decision tree validation process. While many more items were evaluated, these items represent some of the major

observations and conclusions that resulted from the validation process and, as such, are classified into five categories: 1. Fast Flow & Direct Shipment, 2. FTZ, 3. Fit of Existing Methods, 4. Difficult/Complicated Scenarios, and 5. Exceptions. Table 5 lists the item, the specific learning or purpose served by testing that item, and the results of the decision tree process versus the current logistics strategy at the time of evaluation. Variations between the decision tree recommendations and the existing logistics solutions are highlighted and will be discussed in further detail. For confidentiality purposes, the items are referred to generically and any potential cost savings that may be realized will not be disclosed.

Table 5. Sample materials from decision tree process validation.

Item	Description	Purpose	Decision Tree Strategy		Existing Strategy	
			Warehouse & Transport. Strategy	Ownership Strategy	Warehouse & Transport. Strategy	Ownership Strategy
<b>Fast Flow &amp; Direct Shipment Examples</b>						
A	Packaging supplies	Is it fast flow or direct ship?	Direct Ship	Standard Terms	Direct Ship	Standard Terms
B	J.I.T. drum chemicals	Test fit w/ distributor & fast flow opportunity	Fast Flow	Standard Terms	Direct Ship	Standard Terms
<b>FTZ Examples</b>						
C	Health Equip	New contract & need for FTZ activation	FTZ Store/Hub	Consignment	Store/Hub	Consignment
D	Health Media	FTZ Item imported by someone else	FTZ Hub	Standard Terms	Hub	Extended terms
<b>Fit of Existing Methods to Standard Logistics Solutions</b>						
E	Health Equip	Current method matches decision tree recommendation	Fast Flow	Standard Terms	Fast Flow	Standard Terms
F	Health Media	Validate recent contract change	Fast Flow	Standard Terms	Fast Flow	Standard Terms
G	Packaging supplies	Violating set of standard logistics solutions	Fast Flow	Standard Terms	Fast Flow	Consignment
<b>Difficult/Complicated Scenarios</b>						
H	Salts	Item logistics look different from two different site perspectives	Fast Flow	Standard Terms	Fast Flow	Standard Terms
I	Graphic Comm. Equip.	Supplier will not allow Kodak to import	Store	Standard Terms	Store	Standard Terms
J	Photo Chemical	FTZ example - hard to trace through to finished product	FTZ Store	Consignment	Store	Consignment
<b>Exceptions to Reasonable Assumptions</b>						
K	Packaging supplies	No price reduction to take off consignment	Fast Flow	Standard Terms	Fast Flow	Consignment
L	Photo Chemical	Reduction in piece price to put ON consignment	Store	Consignment	Hub	Standard Terms
M	Media	Direct Ship vs. Fast Flow – not cost justified	Fast Flow	Standard Terms	Store	Standard Terms



### **6.2.1 Fast Flow & Direct Shipment Examples**

Item A represents a packaging supply used at KCD that is being delivered directly to the plant by the supplier in frequent shipments throughout the day. The supplier is a stone's throw away from the Kodak site and usage volumes are high so this strategy seems appropriate. When evaluating this item using the decision tree process, the fact that the supplier delivers the material on frequent milk runs throughout the day versus Kodak picking up the material, challenges the definitions of fast flow and direct shipments. Furthermore, it was questioned whether the supplier should continue to make the deliveries or if Kodak should incorporate the supplier onto one of its milk runs. The end result of this example is twofold:

1. The current logistics process is an example of direct shipments and should not be changed.
2. The scope of full truckloads in a direct ship scenario could mean anything from a full-size van to a 53-foot tractor trailer.

Scenarios similar to this have been documented at other Kodak sites and divisions, so the aforementioned guidelines would apply in these cases as well.

Item B is an example of a similar situation but in reverse. In this case, a distributor in Buffalo, NY, approximately an hour away from Kodak Park in Rochester, is making daily or nearly daily deliveries of chemicals to Kodak's cross-dock in a just-in-time fashion. Based upon the lack of full trucks delivering these materials to Kodak, we decided that these chemicals should be on fast flow rather than direct shipments from the supplier. This decision fits in with Kodak's logistics strategy to add materials to existing or potential milk runs in the Buffalo area, separate transportation costs out of the piece price, and avoid unscheduled traffic and dock congestion at its cross-dock. This scenario presented two "firsts" for the decision tree:

1. Aggregation of materials when applying the decision tree process; meaning that, rather than evaluating item #12345678, all items that had the same characteristics were grouped together for evaluation using the decision tree.
2. Evaluation of items coming from a distributor.

We found that both of these factors, material aggregation and distributors, were transparent to the functionality of the decision tree.

### **6.2.2 FTZ Examples**

Item C is a large, expensive component that is manufactured in Europe and used in manufacturing digital health equipment. This was an opportune item for evaluation because contract negotiations were still ongoing; therefore, changes could be made if necessary, without a great disturbance. The imported item carries a duty of 0.8%, which is quite expensive, is a candidate for inverted tariff savings, and most of the finished equipment is exported out of the U.S. While this item presents a great opportunity for duty savings, it requires that the manufacturing location at Kodak Park be transitioned over to SAP and activated as an FTZ.

Despite this roadblock, the decision tree recommended a sound course of action for a logistics opportunity that is worth pursuing in the future.

Item D is a material used to manufacture dental packets for x-rays, which is imported from Germany, and carries a hefty duty of 2.2%. Furthermore, dental packets, the finished product, have no associated duty; therefore, a huge potential for inverted tariff savings exists and the manufacturing site is already classified as an FTZ. Despite these positive factors for duty savings, this material is not operating as an FTZ item, and Kodak is not benefiting from all of the potential import savings because a third party—not Kodak—is importing the item into the U.S. As a result, this eliminates any chance that Kodak has for an inverted tariff relief or merchandise processing fee savings once the item enters into the customs territory of the U.S. This scenario highlights the possibility for missed or hidden duty savings. When a distributor or third-party broker is used for materials such as these, and Kodak is not responsible for clearing the item through customs, it becomes much more difficult to recognize these duty-saving opportunities.

### **6.2.3 Fit of Existing Methods to Standard Logistics Solutions**

Items E and F are examples of materials with existing logistics strategies that matched to the solutions recommended by the decision tree. Item E brought up the unanticipated and unusual scenario of an imported item that fits into a fast flow strategy. Generally, imported items are coming from great distances, so these items would usually fit into a store or hub model. Item E helps to validate that, even in situations like these, the most sensible logistics solution will still be selected using the decision tree. Item F is a more cut-and-dry example of an item that recently moved to fast flow but had previously been on less frequent shipments and stored at Kodak. Although these examples were a mere exercise in validating the decision tree criteria and flow, they also highlight the fact that in some cases proper solutions were identified and implemented without the guidance of the decision tree.

Item G is an example of just the opposite of Items E and F. Item G violates the set of standard solutions because it is on fast flow while also on consignment. This situation resulted because the item had recently been transitioned to fast flow, but during this process, the consignment piece of the strategy was not addressed. This situation highlights the fact that a logistics solution does not just describe how an item gets to the customer, or where the inventory is stored, or who owns the inventory, but a combination of all three of these factors.

### **6.2.4 Difficult & Complicated Scenarios**

Item H is an interesting example because both Kodak Park in Rochester, NY and Kodak Colorado (KCD) use this item. The item is imported from Europe by Eastman Kodak Company's customs brokers to Kodak Park in Rochester. It is sent by fast flow on Kodak trucks from Kodak Park to KCD. From KCD's standpoint, this item should be, and is, on fast flow with standard ownership terms. From Kodak Park's standpoint, this is an imported item that must be stored or put into a hub and has the potential to be classified under an FTZ. This example highlights the significant differences in logistics strategy that could occur simply due to variances in a person's location or perspective in the supply chain. Therefore, instituting site-based teams is important so that items are evaluated appropriately for each location where they are used, instead of on a global basis.

Item I is an item similar to Item D in that Kodak does not have customs clearance responsibility. This item is manufactured in Europe and imported by the supplier's U.S. subsidiary in Connecticut. As a result Kodak is potentially missing out on duty savings opportunities. The interesting catch in this relationship is that the supplier is not willing to give up control of the importing and customs clearance responsibility; therefore, an analysis of Kodak's other supply options may be necessary. Alternatively, Kodak could determine the potential duty savings of using an FTZ and offer up a percentage of that to the supplier in terms of a higher piece price.

The final complicated scenario involves the ease of determining and documenting FTZ savings for some items. Item J is an input from Japan to a photo chemical manufacturing process at Kodak Park. Due to the complicated nature of this process, it is not always easy to track a raw chemical all the way through the manufacturing process and specify the finished good of which it is a part. If the item is being evaluated for export duty savings, it may be difficult or impossible to determine how much of that raw material is in the finished good versus how much was lost or wasted in the manufacturing process. These tasks would be tedious and very time consuming when considering all of the raw chemicals that are used by Kodak and imported from overseas. As such, at the time of this thesis, determining duty savings from raw chemicals that are transformed in Kodak's FTZs was not a priority.

#### **6.2.5 Exceptions to Reasonable Assumptions**

The last few examples represent anomalies to some of the author's expectations regarding market pricing and lean logistics. The assumption relating to market pricing is that piece price would increase if Kodak set up a consignment agreement with a supplier because the cost of capital for holding inventories would transfer from Kodak to the supplier. The lean logistics assumption is that transportation costs for fast flow would be cheaper than infrequent shipments and storing inventory at Kodak for several reasons: Kodak-operated milk runs have high capacity utilizations that are averaging above 85%,<sup>60</sup> Kodak has excellent negotiated transportation rates due to its shipment volumes, and cost of capital savings would be realized because Kodak's money would not be tied up in inventory stores. Although these two rules seem reasonable, they do not always hold true.

Items K and L are highlighted because the ownership strategies under which they are operating vary from what the decision tree recommends. Item K violates the endorsed solutions because it is simultaneously on fast flow and consignment. When a price break was requested from the supplier to take the item off consignment, it was denied because there had not been a price increase when the item was put on consignment. This outcome was not anticipated, which suggests that there may be some cost information asymmetry between Kodak and its supplier. In the case of Item L, a chemical supplier in Asia actually offered up consignment to Kodak in conjunction with a piece price *decrease*! This change would eliminate the supplier's hub facility in the U.S. because the item would be stored at Kodak; since Kodak has unused warehouse space available, it would be a win-win situation financially for Kodak.

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<sup>60</sup> Source: Eastman Kodak Company. "Inbound Milk Run Cross Dock – Logistics Metrics 2005, June."

Item M is an example of a situation in which it is cheaper for Kodak to receive and store monthly direct shipments than to receive daily milk run deliveries. The item in question is manufactured in Taiwan and sent to the supplier's distribution facility in North Carolina. The supplier is a large corporation that is sending substantial volumes of materials from Taiwan to the U.S., and the price quoted to Kodak is for the aggregate transportation costs from Taiwan to the point of use in Rochester, NY. In addition, although Kodak does not currently have a large volume of supply coming from this region to support a milk run, even if it could operate one at 100% capacity, it would still probably not match the aggregate transportation costs that it is paying under the current method. Ultimately, the cost of capital savings on holding 3-4 weeks less inventory in this case is not significant enough to justify much, if any, increase in transportation cost that may result from a milk run.

These three examples are intended to demonstrate that not every situation can be anticipated or accounted for in the decision tree selection process.

### **6.3 CLASSIFYING TOP SPEND MATERIALS BY LOGISTICS SOLUTION**

Once we had defined the standard set of solutions, a poll was done to investigate how these solutions corresponded to the logistics operations for Kodak's existing contracts and purchases. The purpose of this investigation was to see the popularity of each method in existing practices and see how this fit with our expectations. Also, this exercise provided an opportunity to confirm if there was in fact a low occurrence of vendor-managed inventory throughout the corporation. An additional unexpected result was the disparity that was observed between existing user terminology and the standard definitions.

This investigation started by selecting 150 inbound materials that had top spend for the company between April 2005 and November 2005. These items were drawn from across all of Kodak's divisions and locations worldwide, but did not include silver or materials containing silver. Commodity managers, planners, and buyers were directly contacted to gain information regarding the transportation, warehousing, inventory ownership, and inventory management for these materials. Questions were designed to gain the supporting information necessary for us to classify a material under all three logistics categories, rather than trying to explain each standard definition to the people who were contacted. This approach was followed for three reasons: (1) to not get wrapped up in a discussion over terminology, (2) to prevent disparities in the data due to different variations on implementation, and (3) because different sites operated or were structured differently in their approach to inbound logistics.

Table 6 presents the aggregate results of the investigation. In the end, only 121 of the original 150 items were classified. This reduction occurred for the following reasons: some items were found to be obsolete, detailed information was not available for all materials, some materials were experimental in nature or represented special buys, and some items were incorrectly categorized as raw materials but were actually work-in-process (WIP). Regardless, the goal to capture most of Kodak's annual spend by evaluating a small subset of raw materials was achieved in that these 121 materials represent over half of Kodak's 2005 annual dollar spend on raw materials. In comparison, these materials represent a little more than 10% of Kodak's

average ending inventory value, which suggests that many of the items evaluated were under consignment or extended terms contracts. The data in Table 6 support this speculation.

Table 6. Fit of top-spend inbound materials to standard logistics solutions.

<b>Standard Solutions</b>	<b># Items</b>	<b>Spend Breakdown</b>	<b>Nov. '05 Ending Inventory Breakdown</b>
Direct Ship / Standard Terms	7	2.7%	3.2%
Fast Flow / Standard Terms	14	5.5%	7.5%
Hub / Standard Terms	8	2.6%	6.0%
Store / Consignment	32	51.1%	15.3%
Store / Extended Terms	13	9.3%	11.9%
Store / Standard Terms	47	28.8%	56.2%
<b>Warehousing &amp; Transportation</b>			
Direct Ship	7	2.7%	3.2%
Fast Flow	14	5.5%	7.5%
Hub	8	2.6%	6.0%
Store	92	89.2%	83.3%
<b>Inventory Ownership</b>			
Consignment	33	51.1%	15.3%
Extended Terms	13	9.3%	11.9%
Standard Terms	75	39.6%	72.8%
<b>Inventory Management</b>			
Kodak managed	114	96.0%	96.3%
Vendor-managed	7	4.0%	3.7%

In general, these data align with people's expectations of the penetration of each solution in Kodak's existing inbound operations. For example, we estimated that direct shipment would account for less than 5% of Kodak's materials. The 5-6% of materials on fast flow was legitimate when considering that fast flow for Kodak Park alone was considered to be approximately 11% of annual inbound material spend for Rochester,<sup>61</sup> and annual inbound spend for Rochester was about half that of all Kodak sites worldwide. The very small percentage of materials utilizing a hub strategy, likewise, is not surprising considering the recent efforts to remove materials from the hub and move the location of the hub to a smaller location with a narrower scope of materials and business units served. On the other hand, with the recent push to place materials on consignment, and given that high value and high volume materials that are more likely to be on consignment were evaluated, it is not surprising that over 50% of Kodak's spend is on consignment material agreements. Finally, the amount of Kodak's global material spend with vendor-managed inventory is under 5%; this was the estimate used when deciding to not include inventory ownership as part of an overall logistics strategy decision.

<sup>61</sup> Source: Eastman Kodak Company. "Inbound Milk Run Potential to Kodak Park."

## **6.4 RESULTS**

All three of these activities were a valuable part of the development, definition, and standardization of the logistics solution set and the decision tree process. More specifically, the following benefits resulted from these three phases:

1. ***Substantiation of the decision tree process and logistics solution*** set through the decision tree workshop and Kodak's top spend classification.
2. ***Preview and feedback opportunity for the stakeholders*** of this process at a relatively early stage through the decision tree workshop.
3. ***Demonstrated pull for this thesis work***, since we observed large variations in logistics knowledge levels, terminology, and implementations during these activities.
4. ***Concrete, precedent-setting examples*** that will be a guide and a standard for making future logistics decisions.
5. ***Valuable insights and sound approaches for how the decision tree can be used*** to handle the variety and logistical difficulty of Kodak's inbound materials.

## **6.5 SUMMARY**

The decision tool workshop was an important step in introducing the decision tree, achieving buy in to the process, and moving toward validating and implementing the decision tree. Several important realizations came out of the validation process: (1) the decision tool can be used to evaluate items in aggregate and items coming from a distributor, (2) FTZ savings opportunities can easily be overlooked if Kodak does not have responsibility for clearing foreign items through customs, (3) site-based teams are essential to providing an accurate prospective on items used at multiple locations, and (4) the logistics solution that provides the lowest delivered cost may not be the one that is anticipated. In general, through the validation process, a set of concrete examples was developed that that will serve as a standard and guide for future logistics decisions. Classifying items with top spend verified our belief that VMI represented less than 5% of Kodak's annual spend, confirmed that there is a large percentage of materials by value that are on consignment, and demonstrated that there is room for growth of the fast flow strategy.

## **CHAPTER 7 DECISION TOOL IMPLEMENTATION**

The initial scope of this thesis work was to select some specific materials or suppliers for a trial implementation to demonstrate the benefits of following through with a logistics strategy recommended by the decision tree. During the validation process of the decision tree described in section 6.2, several potential materials and suppliers were identified as candidates for this proof of concept implementation. Based upon resource and time constraints, the implementation focus moved away from one or two specific cases to a cross-functional and multi-site implementation strategy that would impact the entire organization. This global approach to implementation was a better fit with Eastman Kodak Company's inventory reduction initiatives than the small, localized changes would have been. In addition, through the decision tree workshop and subsequent presentations to key executives at Kodak, the need for trial implementations to demonstrate the benefits of this process became less and less important. As a result, the implementation phase will focus on the steps needed to roll out the decision tool process, educate users on the decision tree and the standard set of logistics solutions, and determine the order and priority of implementation.

### **7.1 TRIAL IMPLEMENTATION AND STRUCTURE**

As stated in the Decision Tree Preface (Appendix A), the intention is to set up site-based, cross-functional oversight teams to initiate, manage, and control the decision tree process and implementation of the subsequent recommended logistics strategies. The cross-functional teams would, at a minimum, include a representative from Purchasing, Logistics, Planning, Manufacturing, and Finance. The purpose of the stewards would be to have one point of contact for each site team and a person that would have final decision-making or escalation rights in the event of a difficult or indeterminate scenario.

Kodak Park in Rochester served as the site for official introduction of the decision tool process and implementation of inventory reduction efforts on a trial basis. Individuals representing Kodak's various process flows and organizational functions were selected for the team. The intent is to provide this team with detailed education regarding the decision tree and associated set of standard solutions, for this team to lead trials with approximately 40 items that they identify, and to document any disconnects, roadblocks, or lack of resources that are encountered. Once this trial is completed and the kinks are worked out of the system, the intent is to roll the decision tree process out at the user level at Kodak Park and also to identify teams and initiate this process at Kodak's other sites. Throughout all of these steps, education will be prevalent and paramount.

### **7.2 EDUCATION**

This is perhaps the most important part of the implementation process for several reasons: First, one of the most prevalent causes observed for selecting a substandard logistics solution was the lack of knowledge regarding all of the logistics solutions that existed. Second, there are so many inbound materials and suppliers that not every decision made using the decision tree process can be re-evaluated and scrutinized. Finally, the users of the decision tree process already have the important information regarding materials and suppliers, but this knowledge cannot be fully

exploited without an understanding of the standard selection process. The process and materials that will be used to educate and roll out the decision tree process were not developed as a part of this thesis work; however, some of the user tools necessary to implement the decision tree process and inventory reduction efforts were either developed or outlined for future development.

### **7.3 USER TOOLS**

Aside from the actual decision tree itself and the supplemental worksheet and financial models, there are a series of tools that will be integral to the training and utilization of the decision tree process for inventory reduction efforts. These resources include the CMIS Browser, discussed in section 3.3.4, a user manual outlining standard definitions and actions, updated purchasing procedures and forms, and information systems to promote information access and sharing among all of Kodak's divisions and locations. The purpose and content of each of these are discussed in detail below.

#### **7.3.1 CMIS Browser**

The CMIS Browser is a useful tool for searching for, sorting, and aggregating data. It has many applications for a variety of users. Planning and manufacturing can check inventory levels, purchasing can look at spend for a material or supplier, and logistics can use it to identify opportunities for transportation consolidation. We expect that this tool will be used to identify areas of opportunity for inventory reduction efforts and to measure performance metrics over a period of time; however, if people are not aware that it exists and are not familiar with its use, it will not serve its intended purpose.

#### **7.3.2 User Manual**

While the decision tree specifies how to select a standard logistics solution, a user manual will provide a standard course of action for implementing a selected solution. The intent of this manual is to instruct users on the next steps to take once a logistics solution is selected. This is important so that logistics solutions are implemented in a standard way across the company to ensure that the necessary support resources are available, simplify and reduce the amount of work necessary, and make it easier to monitor along the way. The vision is that each of the major logistics options will be outlined: direct shipment, fast flow, hub, store, consignment, extended terms, and standard terms. Each section will include the following information:

- Identifying characteristics of the solution
- Specifications on the accepted flow for information and material
- The information and planning systems that are required
- The approved structure of the logistics and purchasing contracts
- Ownership responsibility for each implementation step
- The subject matter experts who can be consulted for situations of uncertainty, clarification, or verification

#### **7.3.3 Purchasing Procedures**

A purchasing procedure was developed that incorporated the decision tree and supplemental materials and definitions. While this procedure instructs people on what to do and the standard



process that should be followed, we recognize that additional purchasing forms or processes may need to be revised or created. For example, the current request for quote process has consignment listed as a specification not an option, whereas the decision tree process attempts to achieve the lowest delivered cost and would demand quotes for many more options than this. This is just one example that came about during this research work; it is expected that more gaps will be identified as the process is rolled out.

#### **7.3.4 Information Systems**

The final resources that tie into these tools are the information systems necessary to communicate, process, and track procedures, updates, requests, and changes. If a purchasing procedure or user manual is created but not communicated across the corporation, then the effort put into developing these resources will have been futile. The following information systems and resources have been identified and are recommended for a complete and successful implementation:

- A common intranet location where employees can access the decision tree, user manual, and related worksheet, forms, and procedures.
- Access to the CMIS Browser and sufficient capacity for users across the corporation. As additional users and information are added to this tool, the browser could potentially be bogged down to a point at which it loses its practicality.
- Security procedures regarding CMIS Browser access and the data it contains.
- A database to track and communicate the status of inventory reduction efforts, the penetration of standard logistics solutions for Kodak's inbound materials, and activations of new milk runs and foreign trade zones.

#### **7.4 IMPLEMENTATION ORDER, OWNERSHIP, AND PRIORITY**

Tracking the status of implementations brings about the question of priority when implementing many changes at one time. In section 6.2, we discussed the difficult situations that were encountered and the way that materials could be aggregated together for evaluation. These two points lead to the consideration of how to sequence implementation when it is on a much broader scale. In the case of the JIT chemicals coming from a distributor in Buffalo, it was easy to consider them in aggregate; only one supplier, geography, and commodity manager's materials were being considered while evaluating multiple items. Once an example like this is completed, however, users start to think of other geographies or suppliers to which a situation like this might apply. Or perhaps during a departmental meeting, these results are mentioned to another commodity manager who realizes that his materials also fall into the same category. The result is a cascade effect that brings up an important point: In what manner should the implementation of the decision tree and evaluation of materials or suppliers proceed?

Implementation could proceed with a focus on one commodity manager's items, the materials coming from one geographic area, or the suppliers with which Kodak has the largest annual spend. Whichever order is followed, a cascading and overlapping effect will result which will

make this process hard to control. For example, one geographic region may have materials handled by 20 commodity managers that come from 10 suppliers. In this scenario, it may be hard to determine who has ownership over the decision rights for these items. If a cross-functional team is used to make these decisions, which one or two of the 10 commodity managers affected should be an active member of the team and represent the voice of purchasing? While this concern was not addressed by this thesis work due to time constraints, it was discussed and it is a recommendation for action in Chapter 8.

Finally the question of implementation priority must be considered. In general, the course of action is established so that no new “mistakes” are made and order is created before focusing on changes and improvements to existing contracts. As a result, the priority is as follows:

1. Negotiate all new contracts using the decision tree process and set of standard solutions.
2. Fix any current logistics modes that are not being implemented properly or violate the set of standard solutions (i.e., consignment with fast flow).
3. Evaluate all existing contracts and materials against the decision tree process to determine if a logistics change is required.

Step 3 of this process, especially, is where the policies regarding decision ownership, implementation order, and priority will be required.

## **7.5 ROADBLOCKS TO IMPLEMENTATION**

Even if people have been trained, all of the necessary user tools are in place, and an order of engagement has been determined, some roadblocks may still be encountered in the implementation of the decision tree and the standard solution set. Some of these factors are due to resource limitations while others are less tangible organizational factors:

- Time is a limiting factor; both in terms of the time that people have available to devote to evaluating and potentially re-negotiating existing contracts, and the time delays that occur when completing contract negotiations and FTZ activations. Prioritizing tasks and allowing enough time for people to implement the decision tree process and outcomes is an organizational challenge.
- The lack of activated FTZ sites is another barrier—especially when taking into account the time it takes to file for activations and the strict requirements that must be satisfied. This limiting factor depends on U.S. Customs and Border Protection and is mainly outside of Kodak’s control.
- The supplier may be the force preventing a desired logistics solution from being activated. This situation may arise if Kodak does not have buyer power over a specific supplier; in other words, Kodak represents a small part of the supplier’s business or Kodak does not have another available supplier.

- The material planning and tracking system used at a manufacturing site can be another limiting factor. In general, SAP is the preferred system that can handle the complications of consignment and FTZ transactions; however, some of Kodak's manufacturing sites are still using legacy information systems. While some conversions are taking place, they require time and resources that the corporation or business unit may not be willing to commit.
- Lack of a common direction or decision for a particular corporate strategy, such as hubs or consignment, can delay implementations or lead to non-standard practices. While this thesis work initiated some focus in these areas and resulted in some preliminary decisions, the details still need to be worked out.
- Business units or products that are declining will tend to get limited attention and resources, which could prevent the implementation of a valuable solution.

## **7.6 PERFORMANCE ASSESSMENT AND CONTROL**

Maintaining control of the process during implementation is important, yet it is easy to let this responsibility lapse once changes have been made and people move on to the next opportunity. This point touches upon the importance of the continuous improvement tenet of lean theory: How does Kodak measure performance and maintain logistics standards on an ongoing basis? Since the implementation process was in its infant stages at the end of this thesis work, appropriate measures had not been instituted, but some potential performance metrics were identified:

- Percent reduction in inventory
- Inventory levels vs. annual purchasing spend for a site
- Number of materials/suppliers that had been evaluated using the decision tree process
- Number of materials/suppliers operating according to the recommended solution

## **7.7 SUMMARY**

Implementation of the decision tree will proceed through a series of site-based, cross-functional teams with representatives from Purchasing, Logistics, Planning, Manufacturing, and Finance. The key to implementation is education and providing the decision tree users with the necessary tools, some of which include the following: (1) access to the CMIS Browser, (2) a detailed user instruction manual, (3) corresponding purchasing procedures, and (4) supporting information systems and resources. In addition to these requirements, the way in which implementation sequence, ownership, priority, and assessment will be structured still must be determined. Finally, even with all of these factors defined and operational, roadblocks will still exist in the form of deficient resources, legacy information systems, FTZ regulations, and supplier limitations.

## CHAPTER 8 RESULTS AND CONCLUSIONS

The key accomplishments and conclusions that resulted from this project have been identified and discussed throughout the course of this thesis. This chapter will review these results and conclusions and summarize them in one concise forum.

### 8.1 RESULTS

At first glance, the key results of this research are the tangible deliverables such as the decision tree process and set of standard solutions. It is relatively easy to predict the effect of these concrete products from an organizational, operational, or financial standpoint. Not to be overlooked, however, are the intangible results that are more difficult to measure but may be more important to the corporation as a whole. The following is a summary of the results of this thesis project and the actual or estimated benefits to the corporation.

#### 8.1.1 Tangible Products and Benefits

- ***The decision tree is the first and most significant product and is the platform from which all of the other results originated.*** The decision tree provides a standard framework for making logistics decisions; it includes all of the pertinent criteria that a person should consider, and it helps to filter out subjectivity in making these decisions. The supplemental materials to the decision tree include the worksheet to track the process and results, a detailed instruction sheet for the process, calculation tools, a financial model, and data collection and submission forms.
- ***A set of standard logistics solutions has been developed and endorsed by Eastman Kodak Company.*** This finite set of logistics solutions simplified the logistics decision process, reduced the number of resources that would be required for implementation and support, and created an easier environment for implementation and monitoring.
- ***Standard terminology was created and defined for Kodak's global logistics operations.*** This terminology was integral to the development of the logistics solution set and will help to eliminate confusion and simplify logistics discussions and implementations moving forward.
- ***A financial model has been developed to provide guidance in the inventory decision for a material.*** This model allows for finance to be appropriately circumvented for decisions that are clearly black or white; some gray areas of uncertainty may need to be investigated further with the help of a finance representative. The scope of the financial model expanded during the development and validation phases and has led to ongoing activities to create a new, more powerful tool that will include a multitude of input variables and consider a more complex set of outcomes.
- ***The need for the CMIS Browser was identified through this research, and it was validated and improved upon in conjunction with this thesis work.*** The CMIS Browser provides quick access to large amounts of data that can be sorted by value, quantity, supplier,

geography, etc. This tool has useful applications for purchasing, planning, logistics, and manufacturing. It also is an aid in the goal setting and monitoring processes.

- ***The structure and responsibilities of site working teams were identified through this thesis work.*** The original site working team was developed in Rochester for Kodak Park to implement the decision tool on a trial basis while initiating inventory reduction activities.
- ***A purchasing procedure was developed to adopt the decision tree process and incorporate it into the standard work of a purchasing representative.*** This document is a testament to the support of and buy-in to the decision tree process from the top levels of purchasing management. Developing the purchasing procedure helped to highlight changes that would be required for related documents and procedures and in the purchasing organization as a whole.

### **8.1.2 Intangible Outcomes and Benefits**

- ***Kodak's Global Logistics organization's efforts to consolidate and unify the inbound supply chain were advanced through this thesis work.*** Through the decision tree workshop, validation activities, and presentations to executives, the need for and benefits of standardized and integrated inbound logistics operations were publicized and gained support.
- ***People became enlightened and educated on the breadth of logistics solutions that were available for use.*** During the investigation and validation process, we were able to educate people on, and create awareness for, some of the less well-known or complicated logistics solutions. While a limited, finite set of people was affected, we expect that additional benefits will be gained as tribal knowledge cascades through the company.
- ***Awareness for making global logistics solutions was created across many areas of the organization.*** People across Kodak's major business units were influenced, including health equipment, graphics communication, and film and paper consumables. In addition, the functional areas of global logistics, purchasing, finance, and planning were involved.
- ***Areas lacking clear definition were identified and decisions regarding the direction of Kodak's logistics operations were extracted.*** Decisions were made, or the decision process was initiated, on the use of hubs, consignment, vendor-managed inventory, direct shipments, and cross-docks.
- ***An organized construct for approaching and making logistics decision was created.*** This included the creation of the three categories that logistics solutions could be classified into: Warehousing & Transportation, Inventory Ownership, and Inventory Management. In addition, financial models and concrete guidelines for making decisions were established.

## **8.2 CONCLUSIONS AND RECOMMENDATIONS**

A series of conclusions came about during the course of this research work. Some of these conclusions are autonomous while others enabled the progress of the project and led to additional results and conclusions. In addition, we realized several insights along the way but, due to time

constraints, were not able to act upon them during the course of this thesis work. As a result, they are listed as recommendations to Eastman Kodak Company in its pursuit of the decision tree and inventory reduction initiatives.

### **8.2.1 Conclusions**

- Inbound logistics solutions at Kodak can be classified into three main categories: Warehousing & Transportation, Inventory Ownership, and Inventory Management
- There is no one-size-fits-all logistics solution and at the same time not every scenario will be accounted for in the endorsed set of logistics solutions.
- VMI and inventory management options do not fit in with the scope of the decision tree and set of standard logistics solutions in this context.
- The decision tree process fits in well with Kodak's initiative to reduce inventories and will be a useful tool in accomplishing this task across Kodak's sites.
- Factors such as distributors, OEMs, and aggregating materials are transparent to the decision tree process.
- It may not be possible to implement the most appropriate and desirable logistics solution due to implementation barriers that may include suppliers, FTZ restrictions, and time and resource constraints.
- Educating the decision tree users is the most important step leading to a wide-ranging, effective implementation of the decision tree process in inventory reduction activities.

### **8.2.2 Recommendations**

- Implementation of the decision tree will have a cascade effect and therefore it will be important to determine the best order of implementation, i.e., by geography, by supplier, by commodity manager, etc., to avoid confusion and prevent inefficiencies in the process.
- Continuous improvement must be part of the decision tree process and inventory reduction initiative. As a result, it will be essential to determine the appropriate metrics and a method to effectively monitor the implementation process and the results.
- Web-based systems for submitting requests for and real-time tracking of FTZ and milk run activations should be developed; they will empower the decision tree user, help to prioritize and facilitate implementations, and highlight areas of insufficient resources.
- Evaluating and revising corporate objectives and employee incentives may be necessary to successfully implement the decision tree process and achieve the desired efficiency improvements in Kodak's inbound supply chain.

- The purchasing request-for-quote process should be evaluated and revised if necessary to reflect and correspond to the multi-variable logistics decisions that are presented in the decision tree process.
- Expanding the Consignment and Extended Terms Financial Model into a multi-variable financial model with broader scope and capability may be necessary so that logistics options can be evaluated in an interdependent manner.

### **8.3 EPILOGUE**

Since the conclusion of my internship at Eastman Kodak Company, activities to implement the decision tree process in the company's inventory reduction initiative have continued. A database to store and communicate the documents and procedures related to the decision tree process has been established. The inaugural site team that was started at Kodak Park in Rochester, NY has initiated trials and identified some deficient resources that will be needed to fully support the decision tree process.<sup>62</sup> The remaining five sites have been trained on the decision tree process, and as of April 4, 2006, four site teams were established and running with the final site scheduled to start up shortly thereafter. The goal for inventory reduction through this initiative is \$25M by the end of 2006.<sup>63</sup> Earl Chapman, KOS expert in Global Logistics, has been and will continue to be a major driving force in disseminating this process through Kodak's global organization.<sup>62</sup> Ultimately, while the decision tree process, supplemental materials, and implementation may look a little different at the time of thesis publication than was originally planned, the author expects that the same essential concepts, the decision tool, and the set of recommended logistics solutions will live on and become part of Kodak's organization, procedures, and culture.

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<sup>62</sup> Source: Clapper, Darrell. "RE: Updated decision tree & worksheet." E-mail to the author.

<sup>63</sup> Source: Chapman, Earl. "RE: Thesis for review." E-mail to the author.

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## **Author's Biography**

The author, Brooke Kahl, is originally from Warren, MI and she graduated summa cum laude from Warren Mott High School and the Macomb Mathematics Science and Technology Center (MMSTC) magnet school in 1996. She attended GMI Engineering & Management Institute, which later became Kettering University, and graduated magna cum laude with a Bachelor of Science in Electrical Engineering and a Management minor in December 2000.

During her time at GMI, Brooke was a co-op student working first for Delphi Interior & Lighting Systems and later for the General Motors Truck Group. Brooke completed a technical thesis in the area of vehicle programming and diagnostics while working at GM, which received highest honors and was later implemented in vehicle production. Upon graduation, Brooke continued her employment with the Truck Group in Pontiac, MI. Brooke's focus area as a full-time employee at GM was in manufacturing where she worked on the launch of GM's 2003 model year full-size truck program and then moved on to work as a production supervisor at one of GM's truck assembly plants.

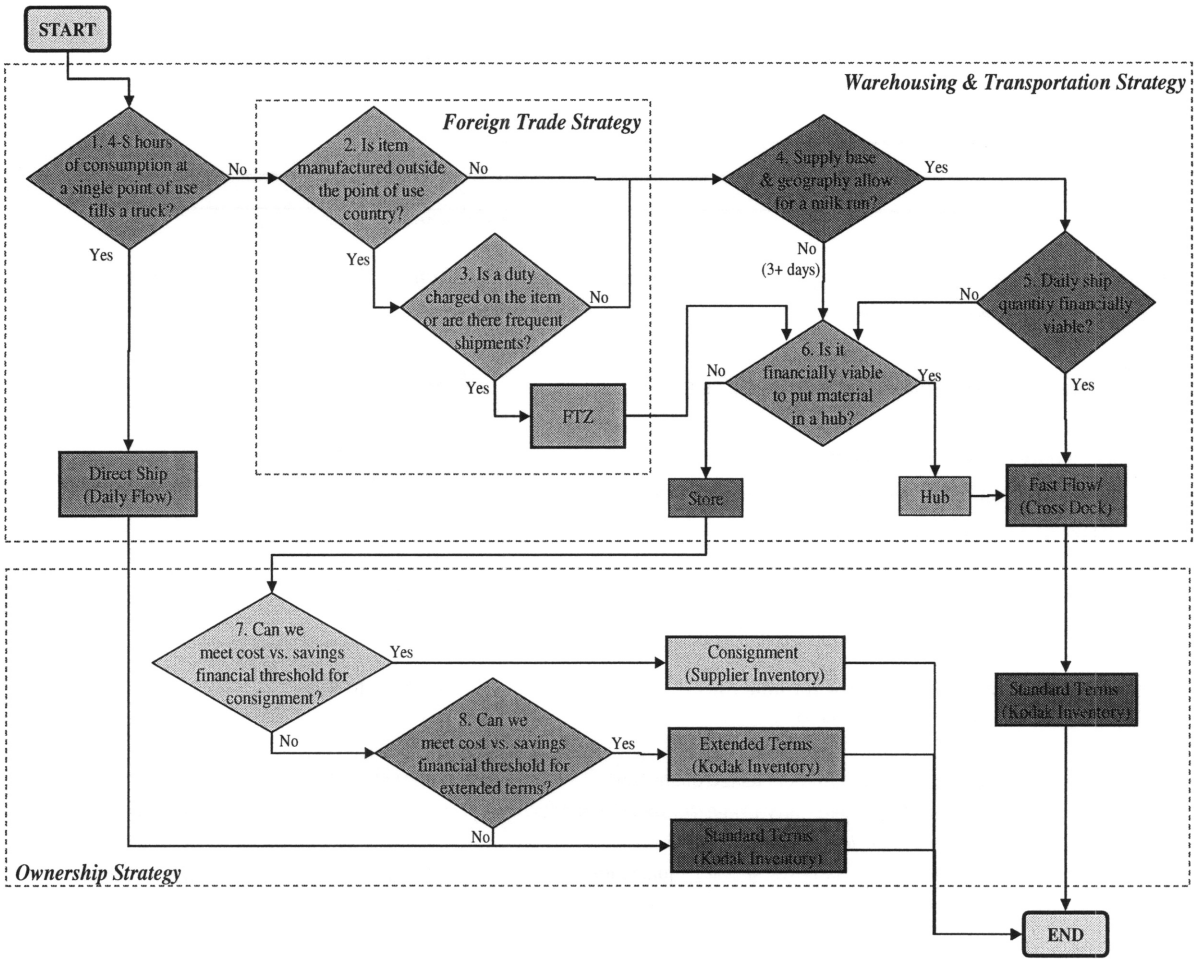
In May 2004, Brooke left GM to return to school to pursue a dual master's degree through the Leaders for Manufacturing (LFM) program at the Massachusetts Institute of Technology. This was a goal that Brooke had set for herself in November 1999 as a senior at Kettering University.

Brooke has accepted a job with Amazon.com as an Operations Manager in the Pathways Rotational Program at an Amazon fulfillment center in Lexington, KY starting in July 2006.

## **Appendix A Decision Tree Preface**

- Objective:** A tool to aid in the selection and implementation of inbound inventory management methods to help standardize Kodak's inbound supply chain, reduce inventory, and save operating costs.
- Why:** The current method of selecting a logistics solution is not standardized; Definitions and implementations of logistics methods vary widely across Kodak; To create a common awareness and understanding across the organization of the logistics tools that are available for use
- Who:** Site-based, cross-functional teams including a representative(s) from purchasing, operations, planning, and logistics should be involved in collecting and evaluating information, selecting the most appropriate solution, and implementing the selected method
- When:**
1. New materials/suppliers/contracts
  2. High annual spend suppliers and high inventory items in terms of dollar value and days supply of inventory
- What:** All inbound materials from supplier to Kodak, including raw materials, finished goods from OEMs, and goods going through a distributor
- How:**
1. Site-based, cross-functional teams
  2. Evaluate at the "supplier ship-from location/Kodak point-of-use" level
  3. Collect initial item information according to Decision Tree Required Data
  4. Complete Decision Tree Worksheet
    - i. Refer to decision tree illustration as necessary
    - ii. Follow instructions sheet for information that is needed & detailed instructions or calculations
  5. Follow standard work and roles and responsibilities for implementation

# Appendix B Decision Tree



# Appendix C Decision Tree Worksheet

Item #: \_\_\_\_\_  
 Item Description: \_\_\_\_\_  
 Supplier: \_\_\_\_\_  
 Manufacturing Address: \_\_\_\_\_  
 Ship From Address: \_\_\_\_\_  
*Street* *City, State, Zip, Country*

1. Will 4-8 hours of consumption at a single point of use fill a truck?  Yes (check "Direct Ship" & "Standard Terms")  
*Note: Truck size can vary; does not have to be a 53-foot tractor/trailer*  No
2. Is item manufactured outside of the point of use country?  Yes  No (skip to #4)
3. a. Is there a duty charged on the item?  Yes (skip to #3c)  No  
 b. Are there frequent, high value shipments into the U.S.?  Yes  No (skip to #4)  
*See "FTZ Cost Savings Evaluation" to help determine*  
 c. Is item a feasible candidate for an FTZ?  Yes (check "FTZ" box; skip to #6)  
*"FTZ Cost Savings Evaluation" can be used to estimate expected annual savings*  No  
*Submit "FTZ Data Form" to Import Services for confirmation*
4. Does supply base & geography allow for milk runs?  Yes  No (skip to #6)  
*See "Milk Run Lane Database" for determination*
5. a. Can item be shipped in daily (or smaller) usage quantities?  Yes (skip to #5c)  No  
 b. Can quantities be changed to create daily usage volume shipments?  Yes  No (skip to #6)  
*(For example, can pallet quantities be reduced to box quantities?)*  
 c. Is it financially viable to ship in daily (or smaller) quantities?  Yes (check "Fast Flow" & "Standard Terms")  
*See "Shipment Frequency Cost/Benefit Evaluation" for determination*  No
6. Is it financially viable to put material in a hub?  Yes (check "Hub" & "Standard Terms")  
*See "Financial Model" for calculation*  No (check "Store" box & proceed)
7. Do finances warrant that good be put on consignment?  Yes (check "Consignment" box)  
*See "Financial Model" for calculation*  No
8. Do finances warrant that good be put on extended terms?  Yes (check "Extended Terms" box)  
*See "Financial Model" for calculation*  No (check "Standard Terms" box)

**Warehousing & Transportation Strategy\***  Direct Ship  Fast Flow  FTZ  Hub  Store

**Inventory Ownership Strategy\***  Consignment  Extended Terms  Standard Terms

\* Upon completion, one box from each strategy should be checked except in the case of "FTZ" which should also have "Store" or "Hub" checked

## Appendix D Decision Tree Worksheet Instructions

- 1. Information:** Daily usage, shipment quantity, shipment frequency, pallet or container quantity, points of use (POU)  
**Objective:** Determine if it is economical to send full truckloads from point to point  
**Instruction:**  
>> If a truckload is more than the daily consumption at one point of use, check "No" box on worksheet and skip to #2  
>> If a truckload is 4 hours to 1 day of consumption at one point of use, and material can be put "on line" (i.e. not into storage, requiring excess material movement), check "Yes" box on worksheet; process complete  
>> If a truckload is < 4 hours of consumption at one point of use, check "Yes" box on worksheet; process complete
- 2. Information:** Supplier ship from address, Manufacturing origin/location, POU  
**Objective:** Determine if item is imported anywhere and by anyone along the supply chain  
**Instruction:**  
>> If item is manufactured in a country different than the country where the point of use is located (where it will be converted, processed, packaged, etc.), check "Yes" box on worksheet  
>> If item is manufactured in the same country where it will be used, check "No" and skip to #4
- 3. Information:** Supplier ship from address, Manufacturing origin/location, Duties, Export Status, Shipment Frequency  
*[Additional information for part 3c may be necessary: average invoice value, physical process flow, information used for planning, and customs broker]*  
**Objective:** Determine opportunity for savings on duties or fees for imported item (FTZ opportunity)  
**Instruction:**  
>> **a.** Is there a duty charged on the item?  
i. If so, check "Yes" & skip to #3c  
ii. If not, check "No" box and proceed  
**b.** Do shipments occur once a week or more, or are they of a high value?  
i. If yes, check "Yes" box and proceed  
ii. If no, check "No" box and skip to #4  
iii. If unsure, complete FTZ Savings Evaluation for determination  
**c.** Fill out FTZ Data Form to qualify item or candidate as a FTZ opportunity & submit to Maria Dellefave (25-82530) in Import Services for review and determination  
i. If approved by Import Services for FTZ activation, check "Yes" box and skip to #6  
ii. If no approved by Import Services for FTZ activation, check "No" box on worksheet and proceed
- 4. Information:** Supplier ship from address, Manufacturing origin/location, Milk Run Lane Database  
**Objective:** Determine if supplier geography can be accommodated by a milk run pick-up  
**Instruction:**  
>> Determine if supplier's ship from/manufacturing/warehousing address fits into a current milk run or is within the same geographical region (same state, bordering state) of an existing milk run by referring to the Milk Run Lane Database  
i. If yes, check "Yes" box on worksheet and fill out and send Milk Run Data Form to Ed Jones to verify and initiate milk run set-up (edward.c.jones@kodak.com)  
ii. If no, check "No" box on worksheet and skip to #6  
iii. If material is within a milk run region but doesn't fit an existing lane, fill out and send Milk Run Data Form to Ed Jones (edward.c.jones@kodak.com) to document opportunity and evaluate potential new milk run  
iv. If unsure, contact Ed Jones (25-24146) to check feasibility for milk run in region

- 5. Objective:** Determine if daily pick-ups on a milk run are financially viable  
**Information:** Daily usage, lead time, unit value, shipment quantity, shipment frequency, pallet or container qty, average days of inventory [*Additional information (Transportation costs) may be needed for part 5c.*]  
**Instruction:**
- a. Contact supplier to determine if they can have daily or sub-daily quantities available for scheduled Kodak pick-up
    - i. If yes, check "Yes" box on worksheet and skip to #5c
    - ii. If no, proceed
  - b. Can quantities be reduced (i.e. can boxes be shipped instead of pallets, drums instead of tankers, etc.)
    - i. If yes, check "Yes" box on worksheet and proceed
    - ii. If no, skip to #6
  - c. If there is a unit price increase for daily quantity shipments, complete Shipment Frequency Cost/Benefit Evaluation determine cost vs. savings threshold of picking up daily quantities
    - i. If supplier has provided a price quote, and "Implement daily shipments" = "Yes" in cost model, check "Yes" box on main worksheet
    - ii. If threshold can be met through supplier negotiations, check "Yes" box on worksheet
    - iii. If threshold cannot be met, check "No" box on worksheet and proceed
- 6. Objective:** Determine if material should go into a hub or be stored at a Kodak location  
**Information:** Lead time, unit value, average days of inventory, value of inventory on hand, annual material spend  
**Instruction:**
- >> Contact the supplier to determine willingness to use hub model and get price quote if possible
  - >> Use Financial Model for Consignment to evaluate Net Cost/Benefit to Kodak to use a hub
    - i. If supplier has provided a price quote lower than the "vendor estimated price" determined in the model, check "Yes" box on worksheet; process is complete
    - ii. If supplier has not provided a price quote, negotiate for "vendor estimated price" determined by the model, if this can be met or exceeded through negotiations, check "Yes" box on worksheet; process is complete
    - iii. If threshold cannot be met, check "No" box on worksheet and proceed
- 7. Objective:** Determine if a cost-effective consignment agreement can be reached  
**Information:** Lead time, unit value, average days of inventory, value of inventory on hand, annual material spend  
**Instruction:**
- >> If there is not a unit price increase for consignment, determine if there is a price reduction for NO consignment
    - i. If there is a price difference, proceed
    - ii. Otherwise, check "Yes" box on main worksheet; process complete
  - >> Complete Financial Model to determine cost vs. savings threshold of putting good on consignment
  - >> Work with supplier to meet this threshold for consignment without an aging clause
    - i. If threshold can be met in a supplier agreement, check "Yes" box on worksheet; process complete
    - ii. If threshold cannot be met, check "No" box on worksheet and proceed to #8
- 8. Objective:** Determine if a cost-effective extended terms agreement can be reached  
**Information:** Lead time, unit value, average days of inventory, value of inventory on hand, annual material spend  
**Instruction:**
- >> Based upon cost vs. savings threshold calculated in Financial Model, negotiate to meet this threshold through extended terms
    - i. If threshold can be met in a supplier agreement, check "Yes" box on worksheet; process complete
    - ii. If threshold cannot be met, check "No" box on worksheet; process complete



# Appendix E Foreign Trade Zone Data Form

**Foreign-trade Zone Data Form**

Item #	Item Description	Kodak Buyer	Country of Export	Country of Manufacture	Duty	Unit Value	Annual Spend	Shipment Frequency	Average Invoice Value	Consigned (Y/N)	Finished Good	Finished Good Duty	% of Finished Good exported	Plan/Mfg. System	Process Flow for Inventory & Mfg.	Current Broker (Kodak, 3rd party, N/A)
N/A	Lead	J. Doe	Foreign Country A	Foreign Country A	2.20%					N	Dental packets	0%	0%	SAP	B605, B12	3rd party

**\*\* Send completed information to Maria Dellefave in Import Services (25-82530) for confirmation**

## Appendix F Foreign Trade Zone Financial Model

### FTZ Cost Savings Evaluation

#### 1. Delayed Duty or Export Duty Savings

Duty on Item	3.00%	
Item Value	0	(do not use in conjunction with annual spend)
Daily Usage	0	(do not use in conjunction with annual spend)
Operating Days in Year	365	
Annual Spend (if not using item value & daily usage)	\$500,000	(do not use in conjunction with item value & daily usage)
Duty Value (annual)	\$15,000.00	
<b>Item for Export (Yes = 1, No = 0)</b>	<b>1</b>	
% for Export	35%	
Avg. Days of Inventory	7	
Kodak's Cost of Capital	5.00%	
Delayed Duty Savings (annual)	\$0.0394	
<b>Annual Duty Savings</b>	<b>\$5,250.03</b>	

#### 2. Inverted Tariff Potential

Duty on Raw Material	3.00%	
Duty on Finished Good	0.00%	
Difference	3.00%	
Item Value	\$0.00	
Daily Usage	1	
Operating Days in Year	365	
Annual Spend (if not using item value & daily usage)	\$500,000	
<b>Annual Inverted Tariff Savings</b>	<b>\$15,000.00</b>	(This is total inverted tariff opportunity)

(Reductions due to exports are calculated in 'Total Savings' section below)

#### 3. Merchandise Processing Fee(MPF)

Invoice Value	\$500,000.00	-OR-	Unit Value	\$0.00
Fee	0.21%		Shipment Quantity	0
Subtotal Fees	\$1,050.00		Subtotal Fees	\$2.00
Fee to be Paid	\$485.00		Fees to be Paid	\$2.00

MPF Savings (per Shipment)*	\$485.00
# of Shipments/Year	12

\* Assumption: FTZ site is at maximum MPF of \$485/wk.  
(i.e. Total weekly imports have a value of \$230,952+)

<b>MPF Savings (per Year)*</b>	<b>\$5,820.00</b>
--------------------------------	-------------------

#### TOTAL SAVINGS

Duty	\$5,250.03	
Inverted Tariff	\$9,750.00	(This figure accounts for the amount of finished product that is exported)
MPF	\$5,820.00	
<b>TOTAL FTZ Savings</b>	<b>\$20,820.03</b>	

*Fictitious numbers used for example*

## Appendix G Shipment Frequency Financial Model

### Shipment Frequency Cost/Benefit Evaluation\*

#### Cost of Daily Shipments

Unit price increase	\$0.00
Transportation savings (per unit)	-\$2.00
<b>Total change in piece price</b>	<b>\$2.00</b>

#### Inventory Savings due to Daily Shipments

Current unit price	\$1,000.00
Daily usage	1
Average days of inventory	14
Reduction in inventory (days)	7
Carrying cost	5.00%
<b>Potential inventory savings (per unit)</b>	<b>\$0.96</b> [Threshold for piece price increase]

#### If all of the above information is available:

Implement daily shipments	No
---------------------------	----

*\* Fictitious numbers created for example*

## Appendix H Milk Run Lane Database

### FICTITIOUS EXAMPLE

Milk Run	Stop	Origin/Destination	Origin/Destination Address	# of pallets	
				min.	max.
A	1	Acme Inc.	1234 Acme Dr. Acme, NY	7	10
	2	Smith & Son	12 W. Smith Rd. Philadelphia, PA	5	7
	3	A.J. Company	9889 Junction Blvd. Lancaster, PA	9	12
				21	29
B	1	Ace Distributors	5656 Ace St. Ace, VA	7	9
	2	S.P. Wright, Inc.	10015 Wright Dr. Wright, PA	4	8
				11	17
C	1	O.K. Technologies	12345 Okay St. Newark, NY	3	5
	2	API Corp.	135 E. Main St. Palmyra, NY	5	8
	3	Jones Inc.	1996 Jones Dr. Rochester, NY	10	14
	4	BEK Electronics	12 Happy St. Rochester, NY	3	3
				21	30
D	1	Giant Industries	8568 Giant Rd. Baltimore, MD	3	7
	2	Famous Enterprises	96 Famous Dr. York, PA	4	6
				7	13
E	1	Heavy Industries	975 W. Broad St. Worcester, MA	12	15
	2	M.R. Electronics	3456 Capitan Blvd. Albany, NY	7	9
	3	Allstar Inc.	1111 Allstar St. Allstar, NY	4	6
				23	30
F	1	Maple Industries	5678 Maple Blvd. Maple, ON	4	6
	2	HI Inc.	1212 Hillin Dr. Buffalo, NY	5	8
	3	Atlas Enterprises	53 W. Atlas Dr. Buffalo, NY	3	5
	4	Cruisin' Technologies	888 Crusier St. Buffalo, NY	6	8
				18	27

	Available capacity*
	Near capacity*
	Full*

\* Example based upon 30-pallet truck capacity

# Appendix I Milk Run Data Form

Milk Run/Fast Flow Data Form

<i>Item #</i>	<i>Item Description</i>	<i>Supplier Name</i>	<i>Supplier Ship From Location</i>	<i>Shipment Frequency</i>	<i>Shipment Volume</i>	<i>Pallet or Container Quantity</i>
N/A	Black paper	Supplier A	Some City, Pennsylvania	N/A	10 rolls/week	1 roll/pallet

# Appendix J Consignment and Extended Terms Financial Model

## J.1 Estimated Price Model Inputs

<b>Material:</b> Chemical	<b>Supplier:</b> SupplierX		
<b>Current State</b>			
<u>Price</u>			
Unit Price	\$25.00		
Transportation Cost per Unit (if not in unit price above)		\$5.00	
Storage/Warehousing Cost per Unit (if not in unit price )		\$1.00	
Annual Volume	1,000,000		
<u>Terms</u>			
Average Days in Transit	16		
# of days in transit OFF Kodak's books =		0	
Average* Days in Hub or Storage	14		
# of days stored OFF Kodak's books =		0	
Payment Terms (days)	45		
* Note: This would be maximum days if item is already on consignment and current contract is being evaluated			
<u>Vendor Information</u>			
Vendor's Cost of Capital	N/A		
Vendor's Insurance Rate (if additional)	N/A		
	#1	#2	#3
<b>Description</b>	Max Days in Hub=30	Max Days in Hub=45	Max Days in Hub=60
<u>Price</u>			
Unit Price	N/A	N/A	N/A
Transportation Cost per Unit (if not in unit price above)	\$5.00	\$5.00	\$5.00
Storage/Warehousing Cost per Unit (if not in unit price)	\$1.00	\$1.00	\$1.00
Annual Volume	1,000,000	1,000,000	1,000,000
<u>Terms</u>			
Average Days in Transit =	16	16	16
# of days in transit OFF Kodak's books =		16	16
Maximum Days in Hub or Storage =	14	29	44
# of days stored OFF Kodak's books =		14	29
Payment Terms (days)	45	45	45
<u>Vendor Information</u>			
Vendor's Cost of Capital	5.0%	5.0%	5.0%
Vendor's Insurance Rate (if additional)	1.0%	1.0%	1.0%

*Fictitious numbers used for example*

## J.2 Estimated Price Model Output

Material: Chemical

Supplier: SupplierX

		Scenario #1	Scenario #2	Scenario #3	
<b>Calculations (Based on Inputs)</b>		Current State	Max Days in Hub=30	Max Days in Hub=45	Max Days in Hub=60
1) Price/Unit	UOM				
Vendor's Capital Cost	Interest Rate Per Unit Cost	N/A	0.41%	0.62%	0.82%
Vendor's Insurance Cost	Insurance Rate per Unit Cost	N/A	0.04%	0.08%	0.12%
<b>Estimated Vendor Price</b>		\$25.00	<b>\$25.11</b>	<b>\$25.17</b>	<b>\$25.24</b>
Additional rate per unit cost			0.45%	0.70%	0.94%
2) Transportation Costs/Unit (if changing)		\$5.00	\$5.00	\$5.00	\$5.00
Change in the transp per unit cost	% Unit Cost		0.00%	0.00%	0.00%
3) Payment Terms (if changing)					
Change in the payment terms per unit cost	% Unit Cost		0.00%	0.00%	0.00%
4) Storage/Warehousing (if changing)					
Change in the storage/warehousing per unit cost	% Unit Cost		0.00%	0.00%	0.00%
Change in Delivered Cost	% Unit Cost		0.45%	0.70%	0.94%
5) Kodak's Cost of Capital					
Savings for Kodak (cash flow)			0.82%	1.23%	1.64%
( )= Cost to Kodak					
<b>Net Cost/Benefit to Kodak as a % of Purchases</b>			<b>0.37%</b>	<b>0.54%</b>	<b>0.70%</b>
( )= Cost to Kodak					
<b>Net Cost/Benefit to Kodak: Purchase\$</b>			<b>\$93,151</b>	<b>\$134,247</b>	<b>\$175,342</b>
( )= Cost to Kodak					
<b>Threshold \$</b>					

*Fictitious numbers used for example*

### J.3 Price Quote Model Inputs

<b>Material:</b> Chemical	<b>Supplier:</b> SupplierX		
<b>Current State</b>			
<u>Price</u>			
Unit Price	\$25.00		
Transportation Cost per Unit (if not in unit price above)		\$5.00	
Storage/Warehousing Cost per Unit (if not in unit price )		\$1.00	
Annual Volume	1,000,000		
<u>Terms</u>			
Average Days in Transit	16		
# of days in transit OFF Kodak's books =		0	
Average* Days in Hub or Storage	14		
# of days stored OFF Kodak's books =		0	
Payment Terms (days)	45		
<u>Vendor Information</u>			
Vendor's Cost of Capital	N/A		
Vendor's Insurance Rate (if additional)	N/A		
	#1	#2	#3
<b>Description</b>	Max Days in Hub=30	Max Days in Hub=45	Max Days in Hub=60
<u>Price</u>			
Unit Price	\$25.10	\$25.25	\$25.50
Transportation Cost per Unit (if not in unit price above)	\$5.00	\$5.00	\$5.00
Storage/Warehousing Cost per Unit (if not in unit price)	\$1.00	\$1.00	\$1.00
Annual Volume	1,000,000	1,000,000	1,000,000
<u>Terms</u>			
Average Days in Transit =	16	16	16
# of days in transit OFF Kodak's books =		16	16
Maximum Days in Hub or Storage =	14	29	44
# of days stored OFF Kodak's books =		14	29
Payment Terms (days)	45	45	45
<u>Vendor Information</u>			
Vendor's Cost of Capital	N/A	N/A	N/A
Vendor's Insurance Rate (if additional)	N/A	N/A	N/A

\* Note: This would be maximum days if item is already on consignment and current contract is being evaluated

*Fictitious numbers used for example*



## J.4 Price Quote Model Calculations

Material: Chemical

Supplier: SupplierX

		Scenario #1	Scenario #2	Scenario #3	
<b>Calculations (Based on Inputs)</b>		Current State	Max Days in Hub=30	Max Days in Hub=45	Max Days in Hub=60
1) Price/Unit	UOM				
Vendor's Capital Cost	Interest Rate	N/A	N/A	N/A	N/A
Vendor's Insurance Cost	Per Unit Cost Insurance Rate per Unit Cost	N/A	N/A	N/A	N/A
<b>Vendor Price Quote</b>		\$25.00	<b>\$25.10</b>	<b>\$25.25</b>	<b>\$25.50</b>
Additional rate per unit cost			0.40%	1.00%	2.00%
2) Transportation Costs/Unit (if changing)		\$5.00	\$5.00	\$5.00	\$5.00
Change in the transp per unit cost	% Unit Cost		0.00%	0.00%	0.00%
3) Payment Terms (if changing)					
Change in the payment terms per unit cost	% Unit Cost		0.00%	0.00%	0.00%
4) Storage/Warehousing (if changing)					
Change in the storage/warehousing per unit cost	% Unit Cost		0.00%	0.00%	0.00%
Change in Delivered Cost	% Unit Cost		0.40%	1.00%	2.00%
5) Kodak's Cost of Capital					
Savings for Kodak (cash flow)			0.82%	1.23%	1.64%
( ) = Cost to Kodak					
<b>Net Cost/Benefit to Kodak as a % of Purchases</b>			<b>0.42%</b>	<b>0.23%</b>	<b>-0.36%</b>
( ) = Cost to Kodak					
<b>Net Cost/Benefit to Kodak: Purchase\$</b>			<b>\$105,479</b>	<b>\$58,219</b>	<b>(\$89,041)</b>
( ) = Cost to Kodak					
<b>Threshold \$</b>					

*Fictitious numbers used for example*

# Appendix K Worldwide Purchasing Inbound Logistics Procedure



NOTE: All printed copies are 'uncontrolled' documents. The revision number needs to match the electronic master to be valid.

*Eastman Kodak Company*  
*World Wide Purchasing Organization*  
343 State Street Rochester, N. Y. 14650

EK Document Security Classification: Unrestricted Internal Use



## Procedure

Title: Inbound Logistics

Doc Number Draft  
Revision:

Department:  
Worldwide Purchasing Organization

*Draft Procedure*

Implementation Date:

Area:  
Procedures-General

Type of Document:  
Procedure

Review Period - 704 Days

### 1.0 Purpose:

This procedure provides guidance and tools to aid in the selection, definition and implementation of inbound inventory management methods to standardize Kodak's inbound supply chain, reduce inventory, and save operating costs.

### 2.0 Scope:

This global document applies to all inbound materials from supplier to Kodak, including raw materials, finished goods from OEMs and ODMs and goods passing thru a distributor.

It should be used in evaluating new and existing contracts for high annual-spend suppliers and high dollar inventory items.

### 3.0 Responsibilities:

Site based cross-functional teams, including representative(s) from Purchasing, Operations, Demand & Supply Planning and Logistics should be included in collecting and evaluating information, deciding on the most appropriate method and implementing the selected method.

## 4.0 Definitions:

**Annual spend** - The total dollars spent with a supplier for all goods and services they supplied to Kodak over a year.

**Blanket Purchase Order** - A legal document establishing the over-arching parameters by which Kodak intends to purchase materials and/or services from a supplier over a specified period of time.

**Bulk shipment** - raw materials such as coal, iron ore, chemicals, etc. that are stored or transported in large quantities; this would include rail cars, tanker trucks, or silos full of a single material

**Carrying cost** - also called holding cost, carrying cost is the cost associated with having inventory on hand. It is primarily made up of the costs associated with the inventory investment and storage cost.

**CMIS** - Cost management information system is a Kodak developed, cost reporting system, which consolidates materials and labor through out the Kodak enterprise systems into a central database.

**Consignment** - The APICS Dictionary<sup>1</sup> defines consignment as "The process of a supplier placing goods at a customer location without receiving payment until after the goods are used or sold". Under consignment, it makes no difference whether product sits in the customer's warehouse or shelves for two days or two years; the supplier receives nothing until it is used or sold.

**Consigned inventory**- Inventory physically at a customer site that remains the financial possession of the vendor. The inventory is considered transferred when it is used in production by the customer.

**Cost of capital** - Weighted average: how much interest the company has to pay for every dollar it borrows, whether from retained earnings, common stock, preferred stock and/or bonds.

**Cross-docking** - in its purest form cross-docking is the action of unloading materials from an incoming trailer or rail car and immediately loading these materials in outbound trailers or rail cars, thus eliminating the need for warehousing (storage).

**Days Supply**- A calculation that projects how long the current on-hand inventory will last, given a predetermined rate of usage and assuming no replenishment.

Variations include: DSI - Days Supply of Inventory

DOH - Days On Hand

DOI - Days Of Inventory

Days Coverage.

**Daily usage** - the quantity of a good or material that is consumed in a 24-hour period

**Direct Ship** - The conveyance of goods directly from the supplier to the customer's point of use.

**Discrete Purchase Order** - A legal document authorizing a supplier to produce a specified quantity of materials and/or services for Kodak, include delivery schedule, cost, and other relevant, parameters. Kodak is committed (liable) for what has been requested in the order.

**Distribution center**-a facility that conducts the storing, shipping, and transporting of goods

**Duty** - Tax imposed on imported product based on the price paid or payable.

**Duty Deferral or Delayed Duty** - Customs duty and federal excise tax, if applicable, are paid only when merchandise is withdrawn from an FTZ and it enters the customs territory of the country to which it was imported; postponed duty payment. If merchandise is properly exported, duties are never paid.

**Duty Reduction or Elimination** - Goods may be imported into, and then exported from, a Foreign Trade Zone without the payment of duties and excise taxes, except to certain countries subject to trade agreements. Goods may also be imported into, and destroyed in, a zone without the payment of duty and excise taxes if done so under Customs supervision.

**Enterprise Resource Planning (ERP)** - An enterprise-wide system that extends (MRP II) by incorporating all system and organizational functions required to plan and support manufacturing, finance, distribution/logistics and additional areas such as engineering, maintenance, etc. It serves as the base repository for cross-functional data and defines a common usage of technology. Kodak uses SAP, Fourth Shift, and AMAPS as MRP II systems as components of the ERP system.

**Extended Terms** - An agreement between a supplier and customer to delay the ownership transfer of goods beyond the agreed INCO terms.

**Fast Flow** - Kodak-specific term representing the combination of inbound milk runs from suppliers, cross-docking, and outbound milk runs to the Kodak points of use

**Finished goods** - A top level or finished item that requires no further processing.

**Forecast** - a best estimate of Kodak's (customer) demand, which gives visibility to suppliers to allow them to better plan their capacities and resources, yet does not commit/bind Kodak to specific order quantities.

**Foreign Trade Zone (FTZ)** - A designated location, physically marked, which is not in the commerce of the United States. Imported goods admitted into a FTZ do not pay duties until they are withdrawn into the US domestic market. Goods can be used manipulated, manufactured or packaged in the FTZ. **Note:** Whereas, a Foreign Trade Zone is a U.S. Customs term, a Free Trade Zone is a globally used term for programs that delay or eliminate duties.

**Full Truck Load (FTL)** - A term used if the quantity or volume of one shipment(s) fills a standard truck.

**Note:** Full Truck Load is an indication for a truck transporting cargo directly from supplier to receiver.

**Full Container Load (FCL)** - when goods occupy a whole container.

**Hub** - a central facility through which all shipments pass in a transportation system; a site that provides a central repository for inventory to provide a central planning capability in an industry or supply network.

**Imports** - goods brought in from another country.

**Import Services** - A Kodak organization in Global Logistics responsible for Customs compliance on all U.S. imports throughout the Country. Import Services is responsible for providing buyers shipping instructions to insure the proper network is used when importing. The group clears U.S. imports and has responsibility for tracking and monitoring certain import lanes. Utilizing Customs laws, Import Services also operates various Duty Management Programs to reduce, eliminate or obtain refund of duties paid.

**INCO terms** - Trade contract terms established by the International Chamber of Commerce. These terms represent a set of international rules for the interpretation of the principal terms of delivery used in trade contracts. SEE 5.8 INCO Table Reference

**Inventory management responsibility** - The group or organization that manages the systems and processes that identify inventory requirements, set targets, provide replenishment techniques and report actual and projected inventory status.

**Inventory status-** The classification of inventory based on its stage in the processing cycle. Common classifications include raw materials (materials and components not yet transformed from their initial state), work-in-process (partially-completed units of production that have been altered from their original state), and finished goods (end items that require no further processing).

**Kan ban-**used as part of a Just-In-Time production operation where components and sub-assemblies are produced based upon notification of demand from a subsequent operation. Kan ban is actually a simplistic means of both signaling the need for inventory as well as controlling the inventory levels.

**Lane** - shipping along a specific origin-destination pair; typically city to city, but could be state to state, city to state, etc

**Lead-time** - amount of time required for an item to be available for use from the time it is ordered; a summation of order lead-time and transportation lead-time

**Order lead-time** - amount of time required from the placement of an order to the availability of the item or material for shipment

**Transportation lead-time** - amount of lead-time required for an item to be transferred from the supplier's location to the consumer's location

**Less than Truck Load (LTL)-** A term used if the quantity or volume of one or more shipment(s) does not fill a standard truck. LTL carriers generally use strategically placed hubs to sort and consolidate LTL shipments into full-truck-load shipments.

**Less-than-full container load (LCL)** - transportation term that describes shipments that are less than an ocean container in size

**Liability** - A financial amount (cost) by which Kodak is accountable to the supplier under certain conditions of order disruptions. Every effort should be made to minimize this amount to Kodak, while still maintaining as much flexibility as is needed by the manufacturing/BU customer.

**Material Replenishment Agreement** - A formal agreement, either part of a formal Supply Agreement or a stand-alone document tied to a purchase order, between Eastman Kodak Company and a Supplier which contains specific replenishment requirements and considerations to facilitate the ordering/signaling and receipt of materials to Kodak.

**Merchandise Processing Fee (MPF)** = An Administrative fee charged by US Customs for processing import clearances; 0.21% of the value, with a minimum of \$25 and maximum of \$485 per shipment. For NAFTA-qualifying imports and US Goods returned, no MPF is paid.

**Milk run (M.R.)** -a regularly run pick-up or delivery route where several stops are made

**NAFTA** - North American Free Trade Agreement established a free-trade zone in North America; signed in 1992 by Canada, Mexico, and the United States and took effect on Jan. 1, 1994; immediately lifted tariffs on the majority of goods produced by the signatory nations; it also calls for the gradual elimination, over a period of 15 years, of most remaining barriers to cross-border investment and to the movement of goods and services among the three countries

**OEMs** - Original Equipment Manufacturers

**ODMs** - Original Design Manufacturers

**Ownership in transit** - Identifies who retains or assumes ownership of a shipment of goods from the shipping point to the designated Kodak Location.

**Payment Terms** - The agreement between the supplier and customer that details the payment of invoices. Terms define the number of days before the full amount is due and any discounts for early payment and when the payment cycle will start.

**Point of Use (POU)** - A defined location where the customer (Kodak) will consume supplied goods for conversion to product or distribution for sale.

**Raw material-** Purchased items, such as bar stock or food ingredients, transformed by manufacturing operations into an intermediate or finished item.

**Risk of loss -**

**Supplier Ship from address -** The Suppliers address from which the goods are actually shipped to Kodak. This may be different than the manufacturing or payee address.

**Store -** to hold inventory at a Kodak-owned and managed site; Kodak-owned and managed site where inventory is held.

**Supply Agreement -** A formal agreement between Eastman Kodak Company and a Supplier which contains terms, conditions, specifications, pricing, and signature blocks, and is signed by authorized representatives of Kodak and co-signed by the supplier's authorized representative.

**Tariff -** duties imposed by a government on imported or exported goods

**Inverted Tariff -** When manufacturing in a FTZ, Customs allows an import to "lock in" the duty rate of the raw material **or** the finished product (which ever is lower). When withdrawing the finished product into the domestic market, duties are paid at that time. For example, the duty rate on imported printer donor used to manufacture ink cartridges is 3.7 % if imported directly into the United States. However, if that printer donor is brought into a foreign trade zone and manufactured into an ink cartridge, the duty on the finished cartridge, including the printer donor, is 0% of the value for the printer donor that went into the finished cartridge.

**Third Party Logistics Provider (3PL)-** An outsourced provider that manages all or a significant part of an organization's logistics requirements and performs transportation, locating and sometimes product consolidation activities.

**Third Party managed -** logistics strategy in which goods are stored at a 3<sup>rd</sup> party site, inventory levels are managed by the 3<sup>rd</sup> party, and the supplier owns the goods until they are pulled by the consumer and leave the 3<sup>rd</sup> Party site.

**Traditional Inbound Model -** Purchase orders and/or supply agreements identify terms for responsibility of transportation, risk of loss and ownership and Kodak acknowledges a liability when a receipt is performed on the receipt date at a Kodak location against a Kodak PO.

**Unit of measure-** The base unit by which an item is normally stocked, costed and ordered. Unit of measure describes how the quantity of an item is tracked in your inventory system

**Vendor Managed Inventory (VMI)-** An inventory planning and fulfillment technique in which a supplier is responsible for monitoring and restocking customer inventory at the appropriate time to maintain predefined levels. The vendor is given access to current customer inventory, forecast and demand information and initiates replenishment as required.

**Visibility in Kodak's Planning System -** Inventory is visible when the quantities available for consumption and replenishment are planned in the MRP. Note: Some inventories may not be owned by Kodak yet be visible to the planning systems.

**Work in process (WIP)-** Material that has been partially processed but not yet transformed into its final state and not normally usable as is.

**Destination -** means the named place set forth in specified INCO terms in the Supply Agreement

**Kodak Location -** means that area designated in Supply Agreements, where Product will be delivered by a Supplier and held and managed by Kodak (or third party) for ultimate withdrawal and distribution by Kodak pursuant to the terms of the agreement.

**Product** - means the goods to be supplied by Supplier in conformance with the Specifications and to be purchased by Kodak hereunder.

**Receipt Date** - means the actual date Product reaches its Kodak Location.

## 5.0 Procedure

### 5.1 Strategy

The decision tree process consists of two major factors: the Warehousing & Logistics Strategy and the Ownership Strategy. Each item or supplier will have a strategy that draws from each of these categories.

For example: Hub with consignment.

- (a) Warehousing & Logistics Strategy - Defines the process by which goods will physically transfer between the vendor and Kodak. The three possible methods are Direct Ship, Store or Hub, and Fast Flow. Following is a brief overview of when each method is appropriate or preferred:

Direct Ship is preferred when a truckload constitutes a day's worth or less of supply at the point of use

Store is appropriate for use when there are long transportation lead times or low or widely variable demand for a product, also the supplier is not willing to warehouse or consign the goods or enter into an extended terms contract to delay payment for goods; The hub is preferred over this strategy

Hub is the preferred strategy when there are long transportation lead times or low or widely variable demand for a product; The intent is for the supplier to cover the cost to hub the material at a 3<sup>rd</sup> party owned and managed site until Kodak pulls it for use.

Fast Flow is the most preferred method of all; Requires daily pick-ups from all suppliers on a milk run route and a cross-dock to disperse the incoming goods; Fast flow can also pick-up and cross-dock goods through one Kodak site and deliver on to another Kodak site

Foreign Trade Zone is appropriate when goods are being manufactured in a country other than where the point of use is located and if a duty is being charged on these goods. Foreign trade zone is a subset of both the Store and Hub strategies.

- (b) Ownership Strategy - Defines where in the supply chain Kodak assumes ownership of goods. The three defined strategies are Consignment, Extended Terms, and Traditional Terms.

Consignment is generally appropriate for goods with high inventory, highly variable demand, high transportation lead time, or high annual spend.

Extended terms are appropriate for goods with high inventory, highly variable demand, high transportation lead time, or high annual spend when a consignment relationship cannot be established.

Traditional terms are appropriate when inventory levels are low, demand is steady, and/or annual spend is not significant, also if it is not financially viable to set-up an Extended Terms or Consignment relationship.

### 5.2 Decision Tree Overview

### 5.3 Decision Tree Worksheet

5.4 Decision Tree Instruction:

5.5 Possible Outcomes

5.6 Differentiators of Logistics Solution

DISTINCTIONS	DIRECT SHIP	FAST FLOW	HUB	STORE Consignment	STORE Extended Terms	STORE Standard Terms
	POU	Single	Multiple	Multiple	Multiple	Multiple
Nbr Suppliers in Truck from Supplier	One	Multiple	One or More	One	One	One
Inventory Location	Mfg Lineside	Mfg Lineside	3PL warehouse	EK Storage Location	EK Storage Location	EK Storage Location
Supply Qty Demand Qty in 24 hrs	Equal	Equal	Unequal	Unequal	Unequal	Unequal
Ownership Transfer	<i>Data concealed for confidentiality</i>					
Visible in Kodak Planning System						
Supplier Location						
Expected DSI						
Transport Mode from Supplier	Full Truck	Full Truck	Any	Any	Any	Any
Consignment	No	No	No	Yes	Possible	No
Transportation Management	Supplier Managed - Preferred Carrier	Kodak Managed - Contract Carrier	Any	Supplier Managed - Preferred Carrier	Supplier Managed - Preferred Carrier	Supplier Managed - Preferred Carrier
Foreign Trade Zone	NA	NA	Possible	Possible	Possible	Possible
Replenishment Signaling	EK to Supplier	EK to Supplier	3PL to Supplier	EK to Supplier	EK to Supplier	EK to Supplier
Supplier Signaling	e-Commerce EC Outlook	e-Commerce EC Outlook	e-Commerce EC Outlook	e-Commerce EC Outlook	e-Commerce EC Outlook	e-Commerce EC Outlook
PO Quantity	Discrete	Blanket order with systems contract release	Blanket order with systems contract release	Consignment PO (K Order)	Consignment PO (K Order)	Discrete
Logistics Scope	Supplier to POU	Supplier to B502	Hub to B502	Supplier to B502	Supplier to B502	Supplier to B502
Purchasing Contract	Standard	Material Replenishment Agreement	Material Replenishment Agreement	Consignment Agreement	Consignment Agreement	Standard
Supplier Advance Ship Notice	Yes	None	None	Yes	Yes	Yes
Material Flow	Supplier to POU	Supplier to Xdock/ Xdock to POU	Supplier to Hub / Hub to Xdock / Xdock to POU	Supplier to Xdock/ Xdock to Warehouse Location / Warehouse to POU	Supplier to Xdock/ Xdock to Warehouse Location / Warehouse to POU	Supplier to Xdock/ Xdock to Warehouse Location / Warehouse to POU
Receiving	Standard Label	Standard Label	Standard Label	Standard Label	Standard Label	Standard Label



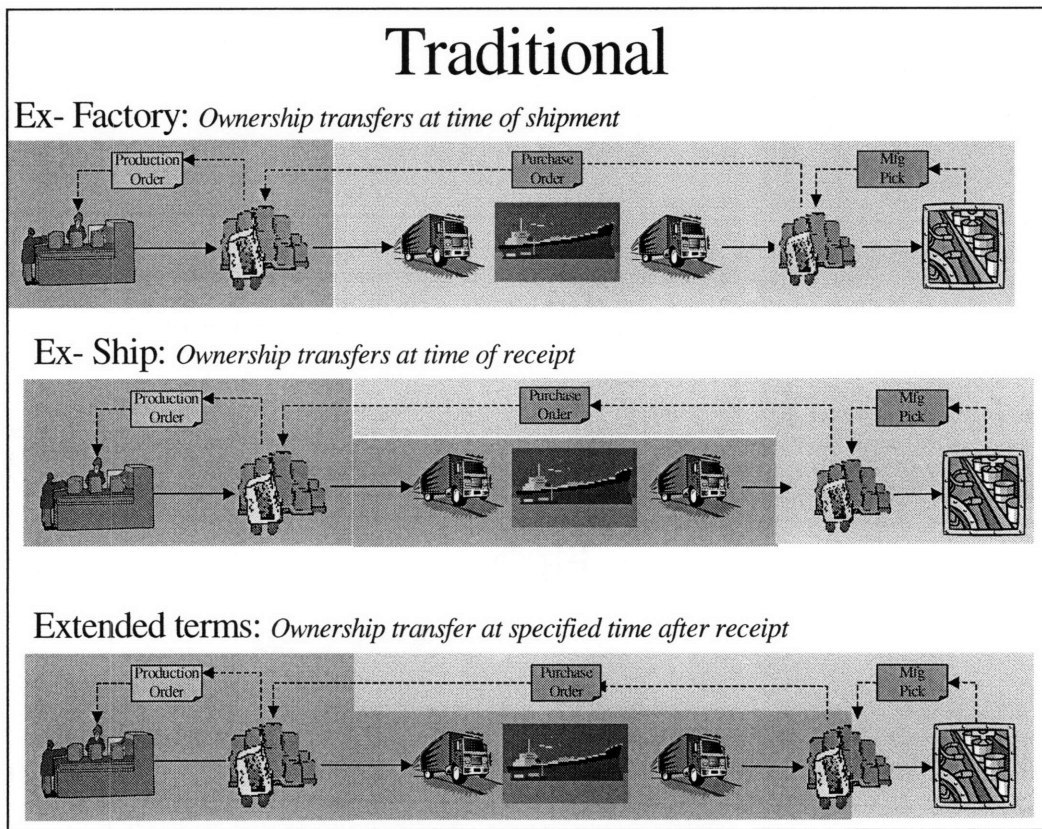
5.7 Cost Model

5.8 Ownership Flows

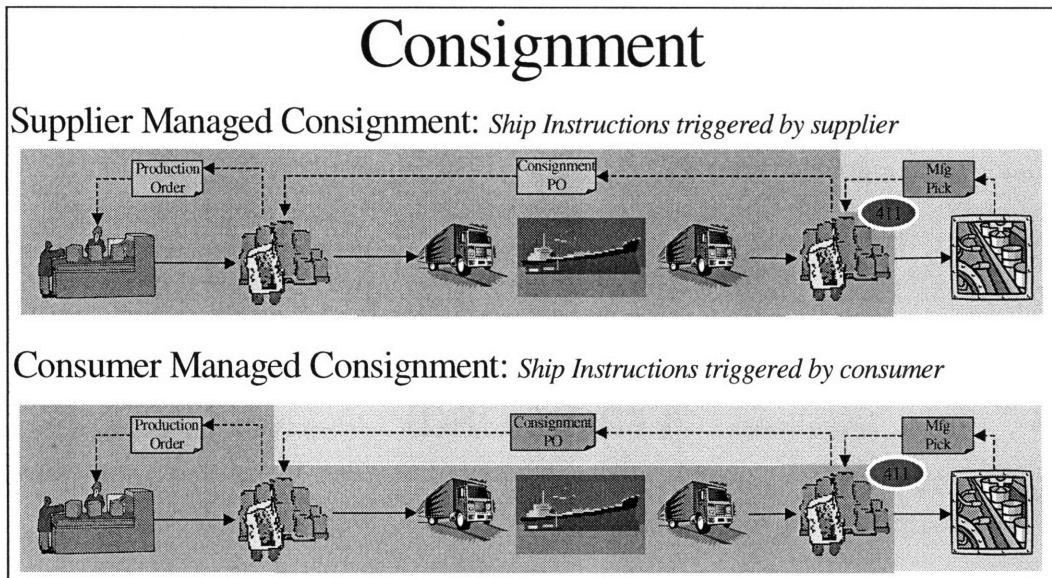
In bound materials that flow into Kodak at rates greater than one days supply should be considered for delayed ownership.

Consignment agreements, extended terms and INCO terms can be used to reduce Kodak's liability of in transit material.

Traditional supply agreements contain clauses, which couples the transportation responsibilities of goods, with the change of ownership for those goods. Two common terms are the buyer assumes responsibility for transportation and ownership at the supplier's site and the supplier is responsible for transportation and the buyer takes ownership at their location. Variations on these processes are diagrammed below.

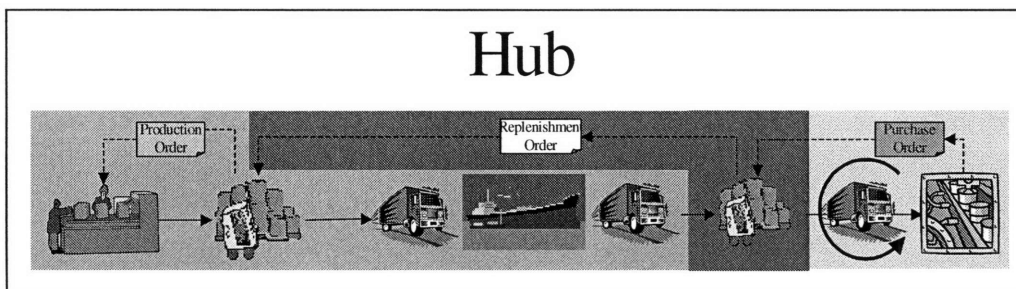


The model, for consignment supply agreements generally, take one of the following models. Supplier Managed Consignment allows ownership of the goods to transfer to the buyer based on inventory movement from a designated location for Kodak use.



\*Formal Consignment (means w/ system inventory records at zero \$ value) should only be used when you need to see inventory records "on line" for planning purposes. (for long lead-time MRP planned materials) or where vendor "Requires" formal inv. Record prior to conception - formal consignment adds lots of extra work and is not very flexible.

Hub/store strategies can be managed by third party logistics providers, suppliers and/or Kodak. The inventory residing at these locations can be consigned and/or Kodak owned. Material availability, reduced lead-times and transportation cost reductions are the reasons to consider a hub strategy.



### ■ Material Flows

- It is important to understand material flows to determine where in the process Kodak ownership should be acknowledged
- Purchase orders must be placed direct between the Kodak Company/Plant where consignment will be stored and the Supplier.
- Material movements prior to taking ownership require a vendor number. This is outside of normal material handler responsibility. (411K, or other movements)
- Should not put material back into consignment inventory (except to correct human error, or to return material to a supplier)

5.9 INCO Terms Reference

<b>INCOTERMS 2000 Responsibility Matrix – Obligations of Importer (Buyer) and Exporter (Seller)</b>													
<b>"E" Departure</b>		<b>"F" Main Carriage Unpaid</b>			<b>"C" Main Carriage Paid</b>				<b>"D" Arrival</b>				
<b>SERVICE</b>	<b>EXW</b> Ex-Works	<b>FCA</b> Free Carrier	<b>FAS</b> Free Alongside Ship	<b>FOB</b> Free Onboard	<b>CFR</b> Cost of Goods & Freight	<b>CIF</b> Cost Insurance & Freight	<b>CPT</b> Carriage Paid to	<b>CIP</b> Carriage Insurance Paid to	<b>DAF</b> Delivered at Frontier	<b>DES</b> Delivered Ex Ship	<b>DEQ</b> Delivered Ex Quay	<b>DDU</b> Delivered Duty Unpaid	<b>DDP</b> Delivered Duty Paid
<b>OBLIGATION AND CHARGES</b>													
Warehouse Service	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Export Packing	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Loading at Point of Origin	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Inland Freight	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Port Receiving Charges	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Forwarder Fees	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Ocean/Air Freight	Buyer	Buyer	Buyer	Buyer	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller
Foreign Port; Foreign Airport	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller	Seller	Seller	Seller
Customs Clearance	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller
Customs Duties	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller
Charges to Final Destination	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer	Seller	Seller

**6.0 Safety & Environmental Information:**

N/A

**7.0 Associated Documents:**

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