A Framework For Optimizing the Supply Chain: A Case Study at Kodak

By

Clinton J. Rockwell

B.S. Mechanical Engineering, University of New Mexico, 1998

Submitted to the Sloan School of Management and the Department of Mechanical Engineering
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Signature of Author _____
Sloan School of Management
Department of Mechanical Engineering
May 5, 2002

Certified by _____
Dr. Stephen C. Graves & Dr. Roy E. Welsch, Thesis Advisors
Sloan School of Management

Certified by _____
Dr. David Simchi-Levi, Thesis Advisor
Department of Civil Engineering

Certified by _____
Dr. Daniel Whitney, Thesis Reader
Department of Mechanical Engineering

Accepted by _____
Ain Sonin, Chairman Departmental Committee for Graduate Students
Department of Mechanical Engineering

Accepted by _____
Margaret Andrews, Executive Director of Master's Program
Sloan School of Management

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ABSTRACT

This thesis proposes a simple method for uncovering inefficiencies and resolving supply chain issues through the use of information flow mapping. As a supporting example, the European Consumer Imaging Division of Eastman Kodak Company in the European, African and Middle Eastern Region (EAMER) is studied. In particular, the process of introducing and discontinuing consumer film products, termed the commercialization process, is examined for improvement opportunities. Although all products in the Consumer Imaging Division use a similar commercialization process, film products provide the most interesting example because they have the most extreme rate of introduction, discontinuation, and product proliferation. To successfully manage environments with this kind of product turnover, it is important to have common and known processes. The EAMER Consumer Imaging commercialization process, however, is neither standardized nor communicated, which leads to excess inventory, long lead times, and variable throughput time, which in turn creates waste, lower customer service, and reduced consumer confidence.

To give both depth and breadth to the analysis, information flow maps are generated at two levels. One analysis maps the systems, spreadsheets, and databases used in the commercialization process, including those of Manufacturing, Planning, and the Commercialization Group. This map provides valuable insight into the commercialization process and exposes redundant systems, information barriers, and operational inefficiencies. The second map is of the entire Commercialization process and allows one to see the opportunities to integrate information across a larger part of the organization including Marketing, Sales, and Manufacturing. Standardization, communication, and an integrated database system are used to minimize inefficiencies in the commercialization process and reduce inventories by approximately $2 million.

Thesis advisors:	Steve Graves, Abraham Siegel Professor Of Management & Chair Of Faculty
	Roy Welsch, Professor of Statistics & Management Science
	David Simchi-Levi, Professor of Civil and Environmental Engineering
Thesis reader:	Daniel Whitney, Senior Research Scientist

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This thesis is dedicated to my younger brother and sister, Jason and Kendra. While this paper signifies the completion of my academic journey, it also signifies the beginning of theirs. I hope that my hard work in academics and the opportunities as a result of that work inspires them to also pursue a higher education and to discover their true interests in life.

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1 INTRODUCTION

The objective of this thesis is to propose a framework for identifying and resolving supply chain improvement opportunities through the use of information flow mapping. Research was conducted in the Consumer Imaging Division in Europe within the European, African and Middle Eastern Region (EAMER) of Eastman Kodak Company from June of 2001 to January of 2002. The thesis has four main sections. Section 1 describes the overall theme and structure of the thesis. Section 2 depicts the project settings and objectives. Section 3 discusses the proposed framework and project solutions. Section 4 describes the results and conclusions.

1.1 Thesis Overview

Before reviewing the subject content of this thesis, it would be useful to define the term "supply chain" as it is used in this paper. According to Future Three, supply chain is: "The functions within and outside a company that enable the value chain[1] to make products and provide services to the customer."[2] From this definition we can glean that supply chain management involves managing the flow of both products and information, either within a company or between companies. A slightly modified and perhaps more insightful definition is one that Simchi-Levi (2000) uses for supply chain management: "A set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system-wide costs while satisfying service level requirements." From this definition, we can see that supply chain management not only involves management of product and information flows but also of

[1] The value chain in this context is simply the entities involved in producing the goods or service.
[2] Source: http://www.future3.com

cash. Pulling the two definitions together, we can conclude that the topic of supply chain involves the flow of products, information, and cash both within and between companies.

While supply chain topics have been around for many years, much of the research and literature have centered on the technical aspects of identifying key issues in Supply Chain Management (SCM) and finding solutions that bring global resolution to those issues. Some of the most commonly researched topics are inventory management, distribution strategies, strategic partnering, product design, and decision support systems (Simchi-Levi, 2000). While the principles behind these techniques are simple to understand, implementing these ideals can be quite complex and difficult for firms. This is mainly because of the paradigm shifts required in thinking about managing a business, integrating activities and processes with supplier and customers, and sharing information and resources across multiple constituents. In fact, some of the most formidable obstacles that must be overcome in Supply Chain Management are not technical in nature at all but rather organizational.

Different stakeholders in the supply chain may strongly disagree on the scope of the project, the ownership of the tasks, the relevance of data, the way data should be shared, and the timing of transactions. Divergent incentives, clashing cultures, misinformed management, and territorial battles often stand in the way of even small improvement projects. Unless an organization is willing to embrace a solution, even if it is analytically perfect, the implementation phase will fail and the bottom line will not be impacted. Perhaps Supply Chain Management is an area where analysis is easier than implementation and is why Jonathan Byrnes exclaims to his students at MIT "Perfect analysis without implementation equals F!" [3]

[3] Quote from Jonathan Byrnes who is a professor at MIT and teaches a course on Logistics and Supply Chain Management

If supply chain improvements are so difficult to implement, how does one identify go about making an impact to the bottom-line? To answer this question, this thesis proposes a simple method for identifying and resolving supply chain problems. While the solutions suggested in this thesis are specific to the EAMER Consumer Imaging Division at Kodak, the structure is intended to be applicable to any supply chain. In particular, the framework presented in this paper tries to help the reader answer the following questions: 1) how does one understand the organization's needs and identify supply chain opportunities, and 2) how does one choose and implement a solution.

1.2 Structure of Thesis

Section 2 of the thesis covers the project description, including a discussion of Kodak in the context of the imaging industry. How the dynamics of that industry have changed and how Kodak has reacted to those changes, in particular the company's transition to Lean Manufacturing. This section is critical to the overall understanding of the paper for two reasons. First, it will help the reader make a connection between the objectives of the thesis and the objectives of the company in which the thesis research was performed. This will also allow the reader to make a distinction between ideas that are specific to Kodak and ideas that are fundamental to the thesis. Second, it is intended to arm the reader with the necessary background information to make connections between this project and their own. This will help the reader determine if the approach presented here can be used for his or her situation. Section 2 also summarizes the attributes of the division where the research was completed, which enable the reader to gauge the complexity of the problem and the potential impacts of the solution. Last but not least, section 2 describes the specific project objectives and the approach used to meet those objectives.

Section 3 describes the proposed framework as well as literature relevant to the thesis. The concepts in this section can be broken into two parts: 1) identifying supply chain improvement opportunities, and 2) resolving supply chain problems and implementing solutions. Part 1, Identifying Supply Chain Improvement Opportunities, reviews the methods used to identify gaps and inefficiencies in the supply chain of Kodak. The primary emphasis is on understanding the organization and a visual mapping technique, called information flow mapping.

The second part of section 3, Resolving Supply Chain Problems and Implementing Solutions, describes three typical solution types in Supply Chain Management including IT systems, process improvements, and modeling/simulation. The goal of section 3 is not to introduce a new and innovative solution to Supply Chain Management but rather to illustrate what types of solutions exist and how the chosen solution may affect success of the project.

This last part of the section also describes methods for implementing supply chain solutions. Implementation, in its most practical form, is probably the most overlooked aspect in Supply Chain Management (SCM). Perhaps this is because the process of getting people to buy into a solution and run with it is more often associated with change management and leadership and not SCM. Despite this fact, a solution cannot add value until it is implemented. Often people become so focused on obtaining the perfect answer they forget to consider the broader issues at hand such as company culture, organizational structure, underlying assumptions, and credibility of the implementer. Yet, it is these issues that are most likely to impede a successful implementation. Section 4, discusses the project successes, shortcomings, and lessons learned.

1.3 Definitions

Several words used in the thesis are context sensitive and/or specific to the research project. Key definitions that will help the reader throughout the thesis include:

1. Catalogue number – A finished goods item with unique characteristics (e.g. 200-speed, 24-exporsure color film in a single box with French language on the carton)
2. Commercialization Group – The team of people responsible for managing the commercialization process.
3. Commercialization process – The process of introducing and discontinuing products to and from the product portfolio.
4. Consumer – Individual buyer of a product (such as a person).
5. Consumer Imaging – The division at Kodak that produces photographic film.
6. Customer – A retailer such as Wal-Mart or CVS.
7. InfoSys – A disguised name for the ERP system at Kodak.
8. MfgSys – A disguised name for the MRP system at Kodak.
9. Portfolio Database – The database where information about film products is kept
10. Product – A finished goods item (see catalogue number)
11. Product portfolio – The platform of products that make-up finished film items.
12. SKU – Stock keeping unit (same as catalogue number except that is differentiated by its storage location).
13. Supply chain – The flow of information, products, and cash within and between companies.

2 PROJECT DESCRIPTION

The research for this thesis was completed in the European Commercialization Group, whose primary function is to manage the introduction and discontinuation of Kodak film in the European region. This function is termed the commercialization process. The following paragraphs give a brief overview of Kodak and the current condition of the imaging industry. Then several key project attributes, such as the project division, group, and location are discussed so that the reader can put into perspective the particular project settings and how they might affect the project motivation and objectives. Finally, a description of the project approach is given, which also serves as a lead into the methods section.

After completing this section, the reader should understand the role of the Commercialization Group, how the commercialization process works, and how the process introduces waste into the supply chain, and the objectives chosen to analyze and minimize this waste. This section should also help the reader gauge the complexity of the problem. Understanding the project description will not only help the reader grasp concepts presented later in the paper, but also enable him or her to formulate a strategy of their own based on the similarities and differences they note here.

2.1 Company Overview

Eastman Kodak Company is engaged primarily in developing, manufacturing and marketing consumer, professional, and health imaging products and services.[4] An entrepreneur named George Eastman started the company in 1888 and quickly took it from a small manufacturer of photographic equipment to one of the largest imaging companies

[4] Company description from StockSelector.com

in the world with over 75,000 employees.[5] Mr. Eastman's original vision was to make the photographic experience more accessible to the 'everyday-man' by simplifying the process and making it affordable. One of the company's earliest strategies was captured in a slogan released in the late eighteen-hundreds, "You push the button, we'll do the rest."[6] Since that time, Kodak has extended its reach into multiple industries and technologies and continually strives to be the world leader in the imaging domain.

To ensure that Kodak achieves its goal, the company has aligned itself into two segments, with six divisions that each focus on a particular piece of the business. The six division are: 1) Consumer Imaging, 2) Digital & Applied Imaging, 3) Kodak Professional, 4) Document Imaging, 5) Health Imaging, and 6) Entertainment Imaging. While Consumer Imaging and Digital & Applied Imaging fall under the Consumer segment, the others are categorized beneath the Commercial segment. The Consumer Imaging division produces consumer film, specialty film, one-time-use cameras, and traditional film cameras. Some of the better-known items in this division include the film families of Kodak Gold, Kodak Advantix, Kodak Kodachrome, and Kodak Elite film. The Digital & Applied Imaging division produces digital cameras, scanners, software, and projectors. Kodak Professional manufactures a variety of high-quality and specialty products including color-reversal and color-negative film to be used by professional photographers. Document Imaging turns out scanners, microfilm, and integrated imaging products such as those that allow micrographic to digital image transfers. Health Imaging is primarily focused on fabricating film for the fields of cardiology, dentistry, radiography, and oncology as well as other scientific imaging fields. Lastly, Entertainment Imaging produces film used in motion picture and television. This includes film used to shoot the

[5] http://finance.yahoo.com
[6] Eastman Kodak website

original storyline as well as film used for copying and distribution to local cinemas and broadcasting stations.

So what are the common themes among these disparate divisions and how do they affect Kodak's strategy? The common themes are innovation, quality, and customer service to the imaging industry. For many years, Kodak had maintained its position as market leader in this industry through rapid releases of innovative designs, high-quality products, and a relentless pursuit to satisfy the customer. Kodak has raised product awareness through aggressive advertising and appealing phrases such as "Take Pictures. Further™", and "Share Moments. Share Life.™" The company has used its internationally recognized brand name to help lead the world market and to attract new customers. In the past, Kodak was able to retain customers by offering promotions, customized packaging, and a myriad of new products, which met the individual needs of each consumer. Although this was an expensive strategy, it allowed Kodak to gain market share, reputation, and huge revenues. Because Kodak had little competition in the first 100 years of operation, they had no incentive to change.

Over the past few years, however, Kodak has fallen under increased pressure to lower film prices and has consequently added cost reduction to their list of priorities. In addition to pricing pressure, Kodak has recently been subjected to changing dynamics in the imaging market such as retailer consolidation, increased competition, and growth in digital demand. Major consolidations of businesses around the globe have shifted market power within the supply chain, giving retailers such as Wal-Mart substantial bargaining power. Competitors like Fuji have lowered prices in an attempt to attract a growing segment of seemingly price-sensitive buyers. Add to this pile the reduction of growth in film demand that digital imaging has caused, and it becomes clear why Kodak has recently taken drastic measures to cut cost and increase profits.

Kodak's primary tool to root out waste and drive down cost is the Toyota Production System, known inside the walls of the imaging giant as the "Kodak Operating System" (KOS). Lean manufacturing and KOS are interchangeable terms but neither is yet well understood by Kodak's general population. Currently, the principles behind lean manufacturing are often confused with the tools that are used to support it. Most people do not realize that lean is a way of thinking; a set of rules, and behaviors that define how organizations make decisions and eliminate waste. Instead, people confuse lean to be the familiar tools associated with waste reduction efforts such as Six-sigma, Kan-ban, and Just-in-time.

The company is doing much to change this paradigm and to make lean manufacturing a regular part of everyone's daily diet. For instance, in a recent issue of a company newsletter, Kodak dedicated a large portion of the journal to discussing lean. In the article, Kodak redefined itself as "a manufacturing culture that aims to provide customers with what they want, in the amount they want, and when they want it." (Kodak News, 2001) This, of course, is what 'lean' companies do and is the strategic direction of Kodak.

Kodak began applying KOS efforts just over 18 months ago to its largest and most profitable region, which includes the US and Canada. The success of these initiatives persuaded Kodak to proliferate the system to other regions beginning with Europe, which is the second largest revenue source for the company. KOS ambitions in Europe included optimization of supply chain components such as product throughput time, inventory levels, and product portfolio size. To help the help evaluate lean improvement opportunities and other supply chain improvement opportunities, Kodak created a seven-month internship assignment, which lead to this project.

2.2 Project Settings

The project settings are described in three parts: project division, project location, and project group. A description of the project division is intended to describe the operations of the division in which the internship was performed. A discussion of the project location describes the peculiarities of the region where the internship was located and brings to light the motivation behind the project. Finally, an overview of the project group discusses the role of the team with whom the research was conducted and how that team fits into the bigger picture.

2.2.1 Project Division

The research for this project was carried out in the Consumer Imaging division, which is a vertically integrated organization that produces a variety of consumer film. As one Kodak employee put it "We begin with cow bones and produce color film products. You can't get much more integrated than that."[7] Although Consumer Imaging produces both film and one-time-use cameras, the research project was primarily focused on amateur and semi-serious photographer film products. Below is a simplified diagram of the manufacturing process for consumer film.

[7] Quote from a former VP and General Manager of the Photographic Products Group, as captured by John Preuninger, "Kodak: Control Through Information Management," Harvard Business School, Case 9-191-060, Revised (March 29, 1993), pp. 3-4.

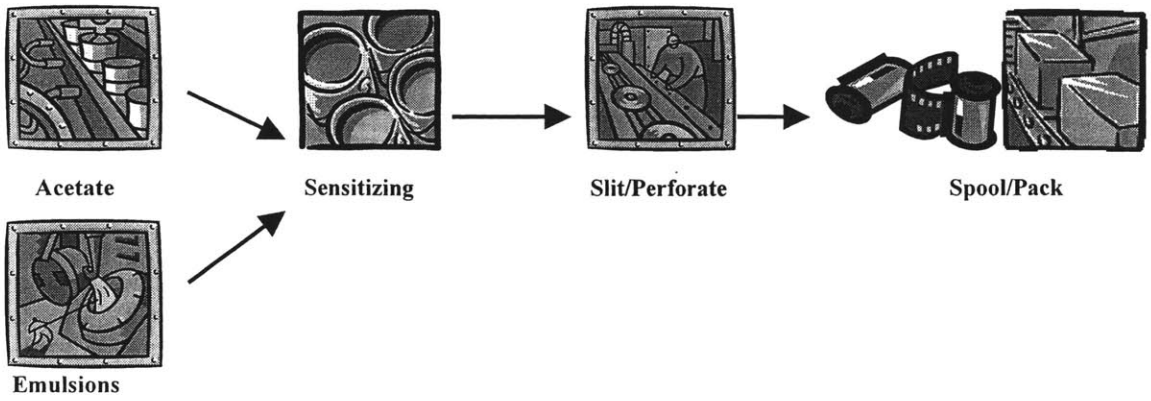

Figure 1: Manufacturing Flow for Consumer Imaging Products

There are five major operations within Consumer Imaging: 1) Acetate, 2) Emulsions, 3) Sensitizing, 4) Slit/Perforate, and 5), Spool/Pack. Acetate produces a clear substrate[8], which is supplied to Sensitizing. The Emulsions department, on the other hand, provides Sensitizing with an array of photosensitive chemicals, which are deposited onto the clear substrate. Both of these operations are run in large batch process, but the value of the product is relatively low in the first echelon of the process, therefore, inventories are not of concern - only in the sense that Sensitizing should never be starved.

Sensitizing is a highly capital-intensive process that deposits chemicals from Emulsions onto the clear film received from Acetate, using a high-speed coating process. While some products have simple coating procedures, others require several hundred layers of chemical deposits on both sides of the substrate. Uniformity, precise mixtures, and high-quality chemicals are all crucial to this process. Because the chemicals are photosensitive, these operations must be done in the dark, which further complicates the process. After the film has been sensitized, it is wound into large rolls called "wide-rolls" and sent to storage. The wide-rolls sit for a period of time undergoing aging and quality

[8] Substrate is the clear plastic substance that chemicals are deposited onto to make film.

checks to ensure that only the highest-quality products are released to downstream operations. Sensitizing, like Acetate and Emulsions, is also a large batch process but not because of low product value, in fact, most film value is added during the Sensitizing operation. The large batches, in this case, are due to the cost and complexity of the equipment and the long setup times required for product changes. Because the cost of the sensitizing equipment is so high, the operational strategy is to achieve the highest utilization, which means fewer changeovers and large batches. Some have compared the complexity of the Sensitizing operation to that of the semi-conductor industry, which uses similar processes to deposit photosensitive chemicals and other substances onto silicon wafers.

After sensitizing, the wide-rolls are transferred to the Slit/Perforate department where they are slit into specified widths (i.e. 35 mm, 110 mm, 120 mm, etc...), perforated, and re-spooled into thinner rolls called "pancakes". Unlike the equipment required for the sensitizing operations, the machines for Slit/Perforate are flexible and can run small batch sizes. Pancakes are then sent to the Spool/Pack department, also known as Finishing. In the Spooling department, film is cut into exact exposure lengths (e.g. 24, 36, etc...) and spooled into canisters, ready for consumer use. The film, at this point, is referred to as "bulk" because it can still be packed into a wide array of package types. This is also the last point where Kodak can perform demand variability reduction strategies such as postponement.

The final operation in the film manufacturing process is called Packing. Bulk product is placed into specific package styles such as single boxes, multi-packs, and merchandisers. Each pack style is customized to accommodate a myriad of languages, promotions, and retailers. The number of packages can be significant for regions such as EAMER, which has many countries, languages, and varying consumer trends. Although

most product value is added during the Sensitizing operation, the Packing operation causes a tremendous amount of inventory in the supply chain because of product proliferation.

2.2.2 A Sidebar on Product Proliferation and the Product Portfolio

The concept of how a few basic film grades turn into hundreds of finished goods and how this affects the product portfolio is important to this thesis and deserves some explanation. Perhaps the easiest way to explain the phenomenon of product proliferation is through a diagram (Figure 2)[9] and reference to the manufacturing process described earlier. To protect Kodak information, the actual numbers have been omitted and replaced by a scaling factor 'x'. For example, if there were 20 film grades, then the number of catalogue numbers would be 600 (= 20 x 30) and the number of SKUs would be 1000 (= 20 x 50). A description of the diagram follows.

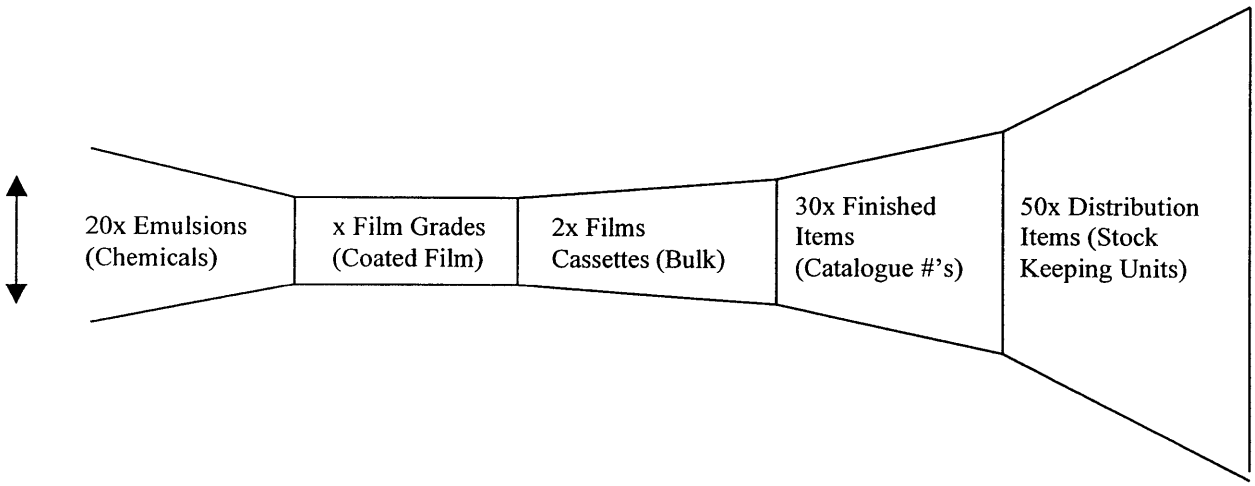

Figure 2: Product Proliferation of Film

The following two paragraphs explain Figure 2 from left to right. Emulsions are the chemicals used to produce film. Many chemicals are required to produce a single film grade. Therefore, the number of emulsions is greater than the number of film grades. Film

grades are differentiated by their product attributes (e.g. 200-speed color negatives, black & white, 400-speed color slides). After film grades (coated films) have been slit into specific widths and perforated, they are passed to the spooling operation where they are cut into different exposure lengths and spooled into metal canisters, also known as film cassettes. Several different cassettes are produced from each film grade causing an increase in the variety of items.

These cassettes are then packed into a plethora of packages, each with different characteristics such as language, shape, and graphics. Thereby causing an even greater variety in items. Each unique package is a finished good item and known as a catalogue number. The catalogue numbers (packed film) are then sent to different warehousing locations and called stock keeping units (SKUs). For instance, if one catalogue number were kept in three regional warehouses then that catalogue number would be associated with three SKUs. In summary, product proliferation is a result of product specialization at each stage of the manufacturing process and can be very extreme, especially if there are many package styles, as is the case in Europe.

The product portfolio is the platform of products that make up finished film items (e.g. Kodak Gold film 200-speed, 24-exposure in a single box with English writing) and can refer to either catalogue numbers or SKUs. Each region in the Consumer Imaging division has its own product portfolio, which is designed by Regional Marketing to best suit the interests and buying habits of that region's consumers. Because film is faced with competing technologies such as digital and ever increasing competition from other manufacture's film products, marketing must continually create strategies that differentiate Kodak products from its competitors. These strategies not only attract consumers but can also cause product proliferation. An increase in the size of the product portfolio increases

[9] Adopted from thesis of Kris Homsi (LFM, 1995), pp. 16 (Numbers have been removed)

the multiplier affect of 'x' in Figure 2 (e.g. as more package styles are added, the multiplier effect of finished goods items would move from 30 to a number greater than 30).

There are three primary methods to introduce products into the portfolio 1) a new film grade is introduced (e.g. Kodak Gold film, Kodak Advantix film, etc...), 2) a re-branding strategy is initiated, or 3) a new package is introduced. The introduction of film grades is managed by corporate marketing, which is also responsible for determining the minimum number of products that each region must carry to comply with corporate standards. For example, corporate may declare that every region must carry a basic portfolio of 100 products (e.g. Kodak Gold Film 400-speed, 24 and 36-exposure, Kodak Gold film 200-speed, 24 and 36-exposure, etc...). Regional Marketing manages re-branding strategies such as graphic art changes that help the consumer to distinguish 200-speed film from 400-speed film. Local marketing (i.e. country marketing) handles new package introductions that are targeted at local events such as the Olympics or local promotions such as buy two get one free. Together, these product introductions cause the portfolio to turnover about once every 18-months. Most turnovers, however, are in the form of package changes and not film grade modifications. More information about the product portfolio and why proliferation occurs is presented in section 2.3 on page 31.

In addition to complex product proliferation, there are cyclical and seasonal demand variations, which introduce variation into the process and further exacerbate inventory problems. Below is a diagram that represents a typical daily demand pattern for consumer film over a period of four-months.[10]

[10] Taken from the Knowledge Review presentation of Manny Gillio's (LFM, 2002)

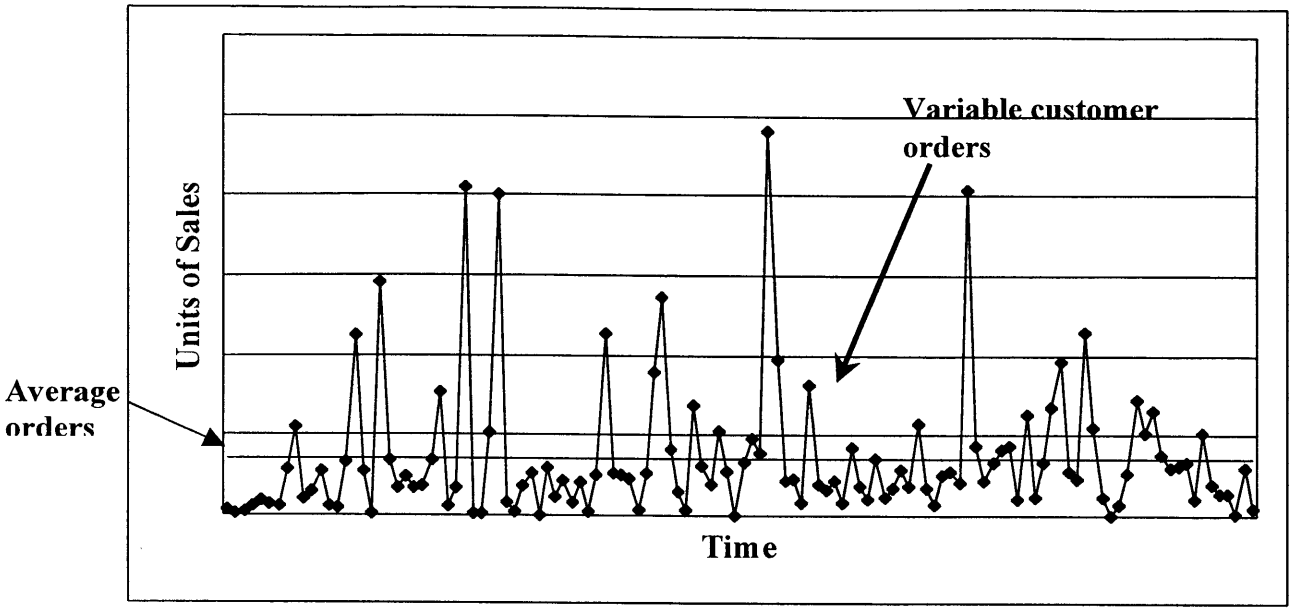

Figure 3: Example Graph of Variable Demand Over Time

Both product proliferation and demand variability cause increased waste and inventories in the supply chain. To effectively battle waste, both the product portfolio and demand variability issues need to be addressed. Therefore, much of the project focuses on managing product proliferation and reducing inventories through portfolio process improvements and increased visibility of the product portfolio. The focus of another intern, (Gillio, 2002), is on mitigating demand variability and the bullwhip effect on manufacturing operations by implementing a visual pull system and an optimized manufacturing process. Both projects are aimed at reducing waste in the system: one through product portfolio management, the other through process improvement.

2.2.3 Project Location

The Consumer Imaging (CI) division of Kodak has manufacturing, marketing, and sales locations all over the world, including major operations in the United States, England, France, Mexico, Brazil, and China. The internship was based in Europe within the European, African and Middle Eastern Region (EAMER) of Kodak. The project was limited to only those products made by CI such as 135 mm and Advanced Photo System

(APS). Not only is CI the most profitable division at Kodak, but it is also the most complex because of the number of products manufactured, the highly volatile and seasonal demand, the length of the supply chain, and in the case of Europe, the disparate locations of the manufacturing sites. Figure 4 shows the European manufacturing flow.

From the manufacturing flow diagram below, one can see that most consumer imaging products in Europe must traverse country borders several times throughout the supply chain. The Sensitizing plant in France receives chemicals from England and Acetate from Rochester, New York. The France site also performs the Slit and Perforate operations and then sends the product back to Annesley, England to be spooled and placed in canisters. From that point the product can either be hand-packed or machine-packed in England by one of the high-speed packing lines or hand-packed in France. Most products are sent to a central distribution center in England and then to one of several regional distribution centers serving Europe.

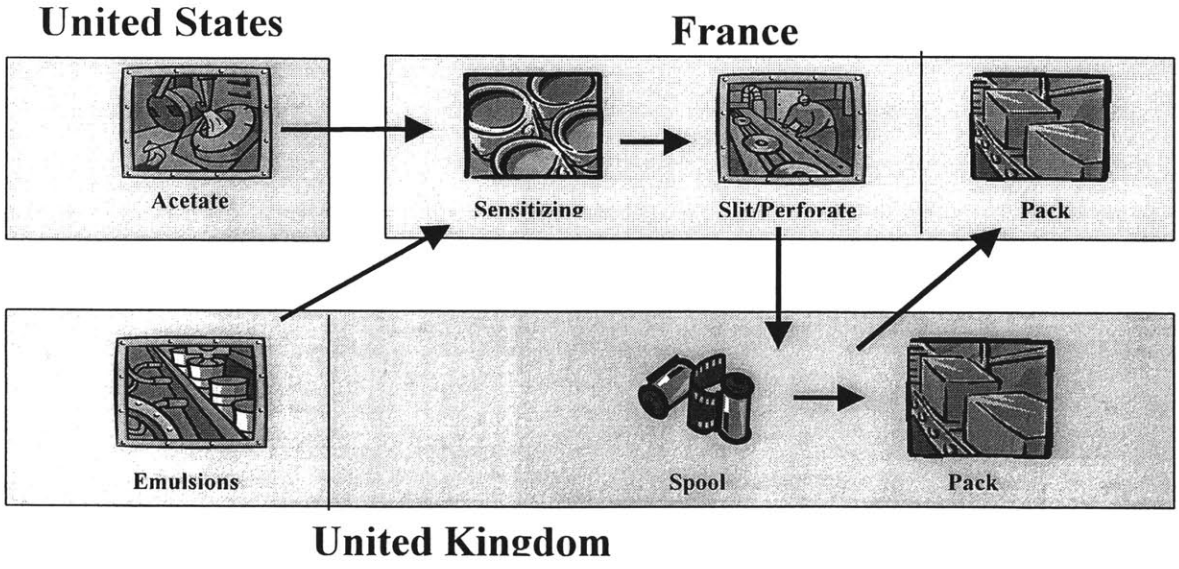

Figure 4: European Manufacturing Flow Diagram

2.2.4 Project Group

The exploration of supply chain improvement was performed within the Commercialization Group. This group consists of a Commercialization Manager and Life Cycle Coordinators. The Commercialization Manager is responsible for understanding the entire portfolio and coordinating product introductions at a strategic level between Marketing and Manufacturing. For example, ensuring that carton suppliers can produce the desired shape and effect of new packages and deliver them to Manufacturing in the desired timeframe. Life Cycle Coordinators (LCC) are tactically focused on a group of countries within the region. Each LCC is responsible for coordinating the life cycle of products (from cradle-to-grave) for their countries. Table 1 shows the typical life cycle of a product.

Table 1: Life Cycle of Film

Product Status	Definition	Key Players
1	Product in planning (Purchasing of raw material OK but no selling)	Marketing, Sales, Planning, and Commercialization Group
2	Plans to introduce product were dropped because business case was not approved	Planning and Commercialization Group
3	Live item (Purchasing of raw material and selling OK)	Manufacturing and Planning
4	Product planned for discontinuance (No purchasing of raw material but selling still OK)	Planning, Manufacturing and Commercialization Group
5	Product discontinued (No purchasing of raw material or selling)	Marketing and Commercialization Group

The primary focus of the Commercialization Group is to mange the life cycle of products by coordinating the introduction and discontinuation of film to and from the product portfolio. This includes managing product specifications such as carton languages,

product status, and catalogue numbers. Although Marketing initiates the process, the Commercialization Group administers it by acting as a liaison between Manufacturing and Marketing. Product introductions were discussed in section 2.2.2 on page 7 and are simply the process of adding a new film grade or package to the product portfolio. Discontinuations are basically the opposite and involve removing an item (or group of items) from the product portfolio. The Commercialization Group is also expected to furnish Marketing with up-to-date information on the size of the portfolio as well as the inventory and sales levels associated with each catalogue number.

The process of introducing and discontinuing film to and from the portfolio is known as the commercialization process and is the main focus of this research project. Although a map of the commercialization process did not exist when the research project began, one was needed to understand the groups involved. Figure 5 shows a map commercialization process (a description follows).

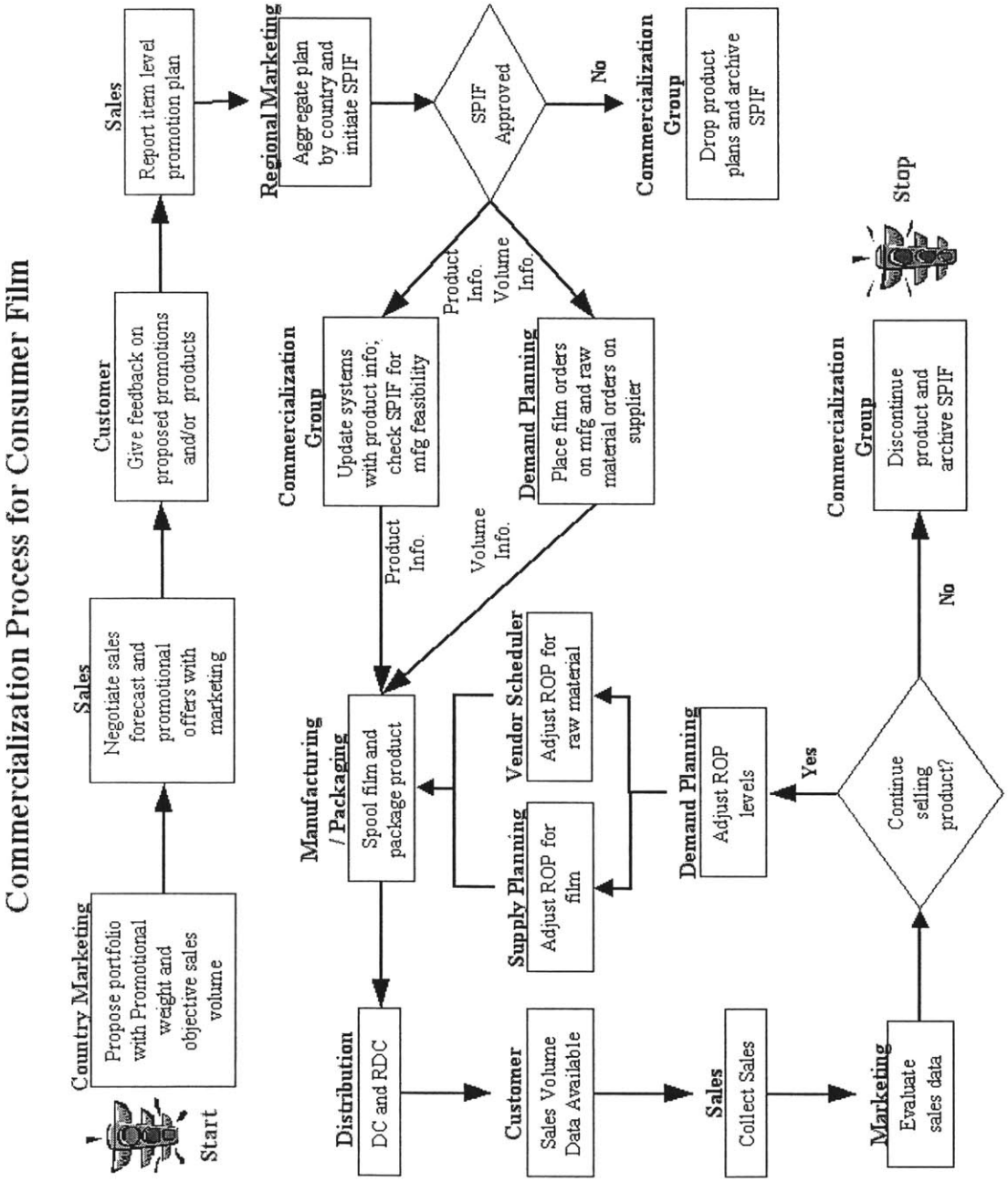

Figure 5: Commercialization Process for Consumer Film

The commercialization process starts when Marketing, Sales, or a customer (such as Wal-Mart) requests a new product (usually in the form of a package for promotional purposes). The product at this point is in planning (status 1). Local Marketing then writes a business case to justify the new product introduction, which is called a Special Product Introduction Form (SPIF). If Regional Marketing rejects the business case, the product introduction plans are dropped and the product moves into status 2. If Regional Marketing (EAMER) accepts the business case, the product moves to status 3. Volume and timeframe information are passed to Planning, while product specifications such as speed, exposure length, and design concepts are passed to the Commercialization Group. Planning aggregates the approved volume information into the ERP system and places orders on Manufacturing.

The Commercialization Group uses the product specification to ensure that graphic designers, carton suppliers, and manufacturing can deliver the desired package at the requested time. The Commercialization Group also creates catalogue numbers and enters information about new products into an Excel spreadsheet (catalogue number, speed, exposure length, countries to be sold in, etc...). Manufacturing produces the product and sends it to distribution to be released to the customers.

Sales and Marketing collect information on how well the product is selling and decide whether to continue or discontinue producing the product. If Marketing decides to continue producing an item, the product stays in status 3. Planning establishes a re-order point (ROP) for finished goods and raw materials so that future orders can be triggered automatically whenever inventories have fallen below the ROP level. Film re-order points are managed through the MRP system, while carton re-order points are managed in an Excel spreadsheet. If Marketing decides that a product should be discontinued, the status is changed from 3 to 4 so that remaining inventories can be sold. The status then moves to 5 and the Commercialization Group is responsible for coordinating the removal

of inventory from warehouses and updating the product portfolio and the ERP system to reflect that the product is no longer being sold. Added cost and complexity not only come from the size of the product portfolio, but also from trying to manage the constant portfolio turnover and status changes caused by promotions and re-branding strategies. Figure 6 relates the commercialization process presented in Figure 5 with the life cycle of film presented in Table 1. Figure 11 shows how the various portfolio management systems fit into the commercialization process.

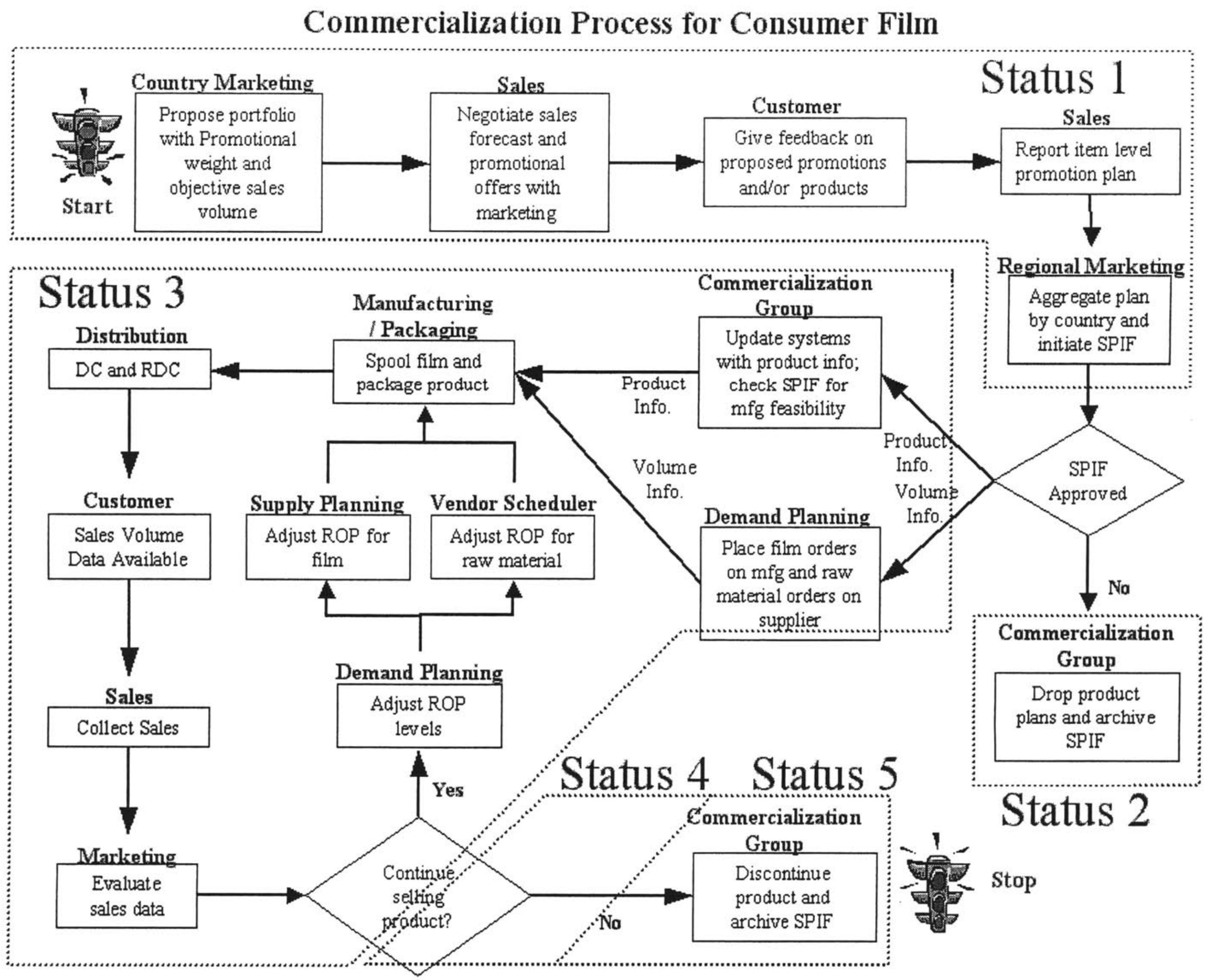

Figure 6: Commercialization Process Map with Life Cycle Statuses Highlighted

2.3 Project Motivation

In the past, the size of the portfolio was not a large concern as customer needs were met through an expansive product portfolio with many promotions and customized packages. At that time, the role of the Commercialization Group was mainly data management and transactional efficiency between Marketing and Manufacturing. Lean manufacturing and cost reduction efforts, however, have changed the focus from product proliferation to product consolidation and meeting customer needs through quick response and competitive prices. As a result, the size of the product portfolio and optimality of the commercialization process have become a more important source of cost savings and efficiency. Accordingly, the role of the Commercialization Group has become more focused on streamlining the commercialization process and finding opportunities to reduce the size of the portfolio.

If a sub-optimal commercialization process and large product portfolio add cost and complexity, then why not just improve the process and reduce the size of the portfolio? There are several reasons why this is a difficult problem including imperfect incentive alignment, process standardization, process compliance, data integrity, and information transfer. First, there is an incentive conflict between those who introduce items and those who discontinue them. Table 2 shows the different groups involved in the commercialization process, their incentives, and the results of those incentives. [11]

[11] Adopted from thesis of Kris Homsi (LFM, 1995), pp. 19

Table 2: Objectives by Job Function.

Function	Incentive	Result
Marketing	Increase market share, sales, and product selection	Larger product portfolio and more inventory
Sales	Increase sales and customer service (on-time delivery)	Increased on-hand inventories
Manufacturing	Decrease unit mfg cost	Larger batch runs and more inventory

Marketing is responsible for maintaining market share. It does so by launching new and enticing products that satisfy the consumer's continually changing needs. Promotions are the most common and disruptive type of product introductions to the supply chain because of the frequency in which they are introduced and their unpredictable demand and lifespan. Although these products keep the consumer's attention, they also increase the size of the portfolio, inventory levels, and complexity of the process. The Sales organization, meanwhile, is measured on its ability to increase revenues. In order for Sales to meet its targets, Marketing must introduce new products and Sales must move those products into the hands of consumers when the consumers want it. To prevent stock-outs and to ensure success, Sales desires to have large amounts of inventory on-hand. Note, however, that in order for product to be sold, it must be entered into the ERP system, InfoSys[12], thereby ensuring that all saleable products are introduced into the ERP software system.

Manufacturing, on the other hand, is constantly trying to drive down costs. So, it prefers a smaller portfolio to prevent frequent changeovers. However, it to drive-up inventories when given a larger product portfolios as a result of maximizing batch runs to lower manufacturing costs. As new products are introduced, Manufacturing pushes to no

[12] InfoSys is a disguised name for enterprise resource planning system (ERP) at Kodak

longer produce "old" products. The issue, however, is that although some products are no longer manufactured, they are not discontinued from the systems (i.e. product must be in system to be sold but not out of the system to stop manufacturing). There has been little to no effort to eliminate this problem because the cost of maintaining this "excess data" in the ERP system is not easily quantifiable and it is therefore difficult to justify the expense of cleaning-up the data.

Because the systems are not "cleaned up," these discontinued products are virtually indistinguishable from live products. This is not only a data management nightmare but can wreak havoc on the manufacturing systems. For instance, if a sales person is looking for a particular item and sees an allegedly discontinued item in InfoSys, he or she can offer that product to a customer and sometimes does. Manufacturing, however, is not prepared to produce this item because they no longer carry the raw materials. But because a promise was made to a customer, Manufacturing must find a way to produce the item, which usually involves expensive expediting of material.

So although new products are being introduced into the system on the premise that they must be on the system in order to be sold, there is no similar incentive for a group to move products out of the system (i.e. discontinue them). The result is that the master data system, InfoSys, becomes inaccurate and people who use InfoSys as a decision-making tool about the product portfolio are misled and misinformed.

The second reason it is difficult to resolve the commercialization and portfolio problem is that the commercialization process has not been clearly defined. Consequently when the process is used, introduction lead times are negotiated on a case-by-case basis, which makes product delivery unreliable. Current introduction times for new packages can vary by as much as ten-weeks. As a result, Marketing tends to ask for items far in advance of the true product need date, which exacerbates the already volatile

demand signals Manufacturing sees. This not only wreaks havoc on the production schedules but also affects the amount of inventories that Kodak must carry to ensure high customer service levels.

Even when processes are clearly defined, the process is not always followed. For example, some countries avoid the commercialization process by doing things such as re-using catalogue numbers. To illustrate the point, assume that France used catalogue number 12345 for a summer promotion of 200-speed, 24-exposure film. After the summer promotion was over, France decided to use the same catalogue number for a winter promotion, which has the same film inside but a different package. In this event, the promotion does not go through the new product introduction process and most likely does not go through SPIF process either. Because the product introduction circumvents these processes, the promotional volume is not aggregated into capacity planning but capacity is still used to produce the products. During peak demand seasons, which is when "sneak" promotions are likely to occur, this causes a strain on Manufacturing which must run at higher than expected utilization rates to meet the unplanned demand.

Because there is little integration between the product portfolios that each department maintains, data integrity also makes it difficult to optimize the portfolio. This was apparent in several meetings setup to discuss the European product portfolio as it usually required some time for the group to reconcile their data to one another. In one instance, one person came to a meeting with a hand-written version of the portfolio, another with an MS Excel spread sheet, and yet another with an MS Access table. We spent the first one-third of the meeting trying to reconcile each of the reports to one another and determine why they didn't agree.

A final difficulty is that groups that should be communicating with one another to optimize the portfolio size and the commercialization process such as Manufacturing,

Planning, and Marketing sometime work in silos. Although, many systems contain relevant data about the product portfolio but none are complete or accurate. In some cases, the lack of having an integrated database with up-to-date information is critical. For example, assume that Marketing decides to discontinue an item (i.e. move an item from status 3 to status 4). The item had been live (i.e. status 3) and selling for quite some time, therefore orders for both finished goods and raw materials were placed based using re-order point process. Also assume that Marketing asked Sales to do a last push on this product to get rid of the remaining inventory. As Sales moved the product, film and raw materials (primarily cartons) were depleted. After a short period of time, the carton vendor scheduler sees that the inventory level for cartons has fallen below the re-order point and triggers an order to the carton supplier. Two-weeks later, Manufacturing finds out that the product has been discontinued and must discard the newly ordered cartons. Although this is a fictitious example, hundreds of thousands of real-dollars are thrown away annually in material that becomes obsolete as a result of these kinds of communication failures and/or lack of data.

2.4 Project Objectives

At a high-level, the original project objective was to reduce manufacturing and distribution cost of 135 mm film by decreasing manufacturing throughput and variability through analysis and optimization of the European integrated supply chain. Because this was a somewhat ambiguous task, a strong effort was put into redefining the scope into something more manageable. As a result of that effort, the project objectives were more clearly defined into two focus areas: 1) investigate and analyze the various systems used to manage the product portfolio in Europe, and 2) investigate and analyze the processes used to manage the commercialization process, especially new product introductions. These two goals were targeted specifically at increasing visibility of the product portfolio, standardizing the commercialization processes, and reducing inventories caused

by the current introduction/discontinuation process and size of the product portfolio. To ensure that these goals were met, three specific objectives were defined:

1. **Identify the cost savings from the elimination of an SKU.** Although reducing the size of the portfolio seems like an obvious step in eliminating waste and reducing inventories, there were people in the European organization who were not convinced that doing so would have any positive impact. This task, therefore, was aimed at providing evidence to those people. Step one was to understand the assumptions behind the current cost savings number being used in the U.S. and other parts of Kodak. Step two was to understand which of these assumptions was applicable to Europe and calculate a specific cost savings number for the European region. Step three was to establish a methodology for determining this number in the future so that it could be recalculated with changing business conditions.

2. **Analyze the processes and systems used to manage the commercialization process in EAMER**. The purpose of this task was to understand the process and systems (i.e. spreadsheets and databases) currently being used to manage the commercialization process. It was also intended clarify the roles and responsibilities of the various owners and users of these systems and to locate points where duplicate data was being maintained and/or points where data was being dropped. The expected outcome of this task was a list of opportunities that could shorten the information flow and make the information more consistent and accurate. The opportunities were also expected to decrease the lead-time of new product introductions and ensure that discontinued products were removed from the systems.

3. **Create an integrated database for product portfolio management.** Because several systems contained information on the product portfolio, it was necessary to determine which of the current databases, if any, should be used as the 'master data

file.' Next, a database was to be created. The point of the database was to have a single point of data collection and review by all parties (instead of ten plus spreadsheets/systems), to have interface tools that would easily allow any user to manipulate the data in a way that turned data into useful information (e.g. provide insight into products that are not selling well and/or products that can be consolidated), and to increase the visibility of portfolio information and the speed in which it was transmitted. A question that arose was "why not just use the ERP database, InfoSys, as the official product portfolio". This question is answered in section 3.3.2.

2.5 Project Approach

Although there were many steps required to identify and resolve the supply chain issues in the commercialization process, only three primary were employed: 1) interviewing, 2) information flow mapping, and 3) prototyping.

2.5.1 Interviewing

Even though the project was based in Europe, it began at Kodak corporate headquarters in Rochester, New York. This opportunity was used to learn more about Kodak business operations from a corporate point of view and to network with employees who were based in Rochester yet had an interest in European operations. For instance, to get a high-level perspective on Europe's most pressing needs, divisional vice presidents from Marketing, Manufacturing, Supply chain, and Finance were interviewed and asked to comment on Europe's operations. While each VP had independent viewpoints and suggestions, their common theme was the size of the product portfolio and Europe's seeming inability to accurately report it. This input catalyzed an effort to create an integrated database for portfolio management so that the portfolio could be accurately reported.

2.5.2 Information Flow Mapping

Once in Europe, the first three weeks were spent traveling to various sites across Western Europe interviewing key players, understanding systems, and building a map of the commercialization process. This map, which was presented in Figure 5, was then used to define the scope of a more detailed system map, presented in Figure 8 . The system map was used with basic lean manufacturing principles such as process standardization and elimination of non-value added tasks to determine which issues were causing the most disruption to the European commercialization process. From this analysis, a list of improvement projects and solutions was generated.

2.5.3 Prototyping

Because change is often very difficult to implement, it is sometimes useful to build a prototype. There are several reasons why people and organizations resist change, but one reason is because the stakeholders do not understand the proposed solution. Creative solutions can sometimes be very difficult to explain without visualization tools. Creating a prototype can breakdown these communication gaps by providing a tangible object that is usually easier to understand, compared to the abstract idea from which it came. In addition, prototypes can build credibility for the inventor, especially for those inventers who can distill a complex thought into an easy-to-understand demonstration.

3 METHODS

The proposed framework includes two steps to improve the supply chain: 1) identify the supply chain improvement opportunities, and 2) generate and implement solutions. Of course, this is a continual process and may require multiple loops. Although these steps do not seem overly complex, the process of going through them is difficult and will determine the success of the project.

3.1 Identifying Opportunities

From chapter 1 we know that supply chain management involves the flow of product, information, and/or cash within or between companies. So when choosing a method to identify supply chain improvement opportunities, a few considerations are: 1) what is important to the organization, 2) which flow (product, information, or cash) should be analyzed, 3) at what level should the flow be evaluated (strategic, tactical, or operational), and 4) what method should be used to identify the improvement opportunities and understand the organization.

3.1.1 Understanding the Organization

Understanding the organization is critical to the success of the project because it allows one to build relationships, credibility, and a problem statement that matters. In order to understand the organization, one must analyze the strategy, culture, and political aspects of the project. Although there are several methods that can be used to understand the organization, site visits and interviews are the fastest and easiest way to do so.

As previously mentioned, the first few weeks of the internship were spent interviewing key people in the organization and learning about Kodak culture and operations. This time proved invaluable to the rest of the research project as it provided vital contacts and a basic understanding of the company's strategic and operational

values. It was during this time that much was learned about Kodak efforts to implement lean manufacturing and the company's desire to improve the commercialization process. Plant tours helped in understanding the film manufacturing process used to produce film. Hands-on activities were used to gain an understanding of operational processes and company culture. For instance, part of this research project included participation in a Kaizen event, which is a small team focused on radically improving a specific set of processes by instituting paradigmatic change. Participation in the Kaizen event brought visibility of how Kodak translates its strategic vision into operational procedures. It also demonstrated the company's ability to effectively catalyze change. Site visits, plant tours, and interviews were continued during the first few weeks of the research in Europe as well.

Recall that the original project objectives were to 1) identify the cost savings from eliminating a product from the portfolio, 2) build an integrated database to help the Commercialization Group manage the product portfolio, and 3) analyze the systems used in the European commercialization process. During the interview process it was discovered that the second two objectives were more valued by Kodak management and the Commercialization Group than the first. As a result, the goal of identifying a cost savings for eliminating an SKU from the portfolio was dropped, which freed precious time for the other two objectives. If extensive interviews had not been completed, this prioritization would have been overlooked, all three projects would have been worked on, and the overall outcome would have been diminished.

It is not always the case that one or two projects become evident as the most important objectives to focus on. If several important issues are identified during the discovery process and it is not clear which are the most important, look for solutions that include the most important elements of each issue. Understand and evaluate the symptoms from both a strategic and tactical level perspective and find the commonality

between the two so a problem statement can be created. Some basic things to think about are: Which problems do you have the skill sets to complete? Which problems are not currently being worked on? Which problems do you have control over (resources, functional alignment, etc...). Which problems will have the highest dollar impact? Which problems seem to be the most important to the company and the people you work with? Create and share a narrowed list of project objectives with all stakeholders and confirm understanding and importance of issues.

3.1.2 Choosing a Flow

Once a basic understanding of the organization is obtained, how does one choose which flow to analyze? Choosing a flow is fairly easy as it is usually dictated by the project objective. For example, one objective of this project was to integrate the spreadsheets and databases used to manage the product portfolio, which deals with information flows. Another objective was to determine the cost savings from eliminating a product from the portfolio, which deals with cash flows. Another intern (Gillio, 2002) was tasked with implementing a pull system for color film manufacturing, which deals with both product and information flows. If a flow is not obvious, start with an information flow as any movement of product or cash is precipitated by that of information.

3.1.3 Choosing a Level

Once a flow has been chosen, how does one choose the level at which to analyze the flow? Choosing a level is also easy but not as intuitive. If the requesting party does not choose a level, then a level should be chosen based on one's maximum sphere of influence. For example, one objective of this project was to integrate the databases used to manage the product portfolio. Although these databases span several functional groups across many European countries, the author only had connections within the

manufacturing organization. Therefore, only the manufacturing systems were studied until credibility was built in organizations outside manufacturing such as Marketing and planning. After determining the highest level of accessibility and/or influence in the organization, expand to the next level through networking and relationship building.

3.1.4 Choosing a Method

At this point, an understanding of the organization has been obtained, a flow has been chosen, and the level at which the flow is going to be analyzed has been chosen. How does one now uncover the improvement opportunities in the given supply chain? Whether you are looking at information, product, or cash flows, visualization techniques are perhaps the most intuitive and most often used method for identifying improvement opportunities in the supply chain. The ability to visualize data such as routes, inventories, and locations is not only important for presentation purposes but also may reveal issues that are otherwise not apparent.

Information flow mapping (IFM) is one example of a visualization technique and is the method used to analyze the commercialization process at Kodak. An article by Susan Henczel (2000), describes information flow mapping as a way to identify gaps, duplications, and flow inefficiencies. Examples include:

- Over/Under resourced systems (resources are given but not required or vice versa)
- Gaps (resources are given but not in the right mix / at the right time)
- Non-standardized processes
- Unlinked systems and tools
- Bottlenecks and inefficiencies (lots going in but very little coming out)
- Pinch points (lots going through a single point)

Other visualization techniques include System Dynamics, Value Stream Mapping, and Enterprise Value Stream Mapping. There are no cookbook answers for aligning a particular method with a particular situation. Much of the choice depends on the type of flow being analyzed, and the level at which the analysis takes place. A good rule of thumb, however, is that the more complex the supply chain problem, the simpler the problem identification method should be. Remember, that "Perfect analysis without implementation equals F" and that the identification method must also act as justification for moving forward with a solution. If the identification method is difficult to understand, then it will be tough to convince management that the problem identified is the right one.

3.1.5 Creating a Map

Now that information flow mapping has been chosen as the visualization technique, it is necessary to define the scope of the map. In this case, the objective is to map and understand the processes, systems, spreadsheets, and databases currently being used to manage the commercialization process. Two pieces of information gathered during the interview process help define the boundaries of scope. First, recall from the description of the commercialization process that the process doesn't actually begin until Regional Marketing approves the Special Product Introduction Form (SPIF). Second, recall from Table 1 that the Commercialization Group is a key player in all stages of the product life cycle except stage 3, when the product goes into the Sales and distribution loop.

Therefore, it is important to map all of the systems beginning after SPIF approval and all systems outside of the Sales and distribution loop. Figure 7 recalls the Commercialization process map and highlights the defined scope of systems to be

analyzed. After the scope was defined, the focus area was mapped through additional interviews and site visits. The resulting map was very extensive and detailed, therefore a simplified version is shown in Figure 8 (a description follows). Note that the system map matches the scope defined in Figure 6, as it begins with Marketing and ends with Distribution. The process of constructing the map should also be used as an opportunity to build credibility and check your understanding of the process by sharing the map with several people.

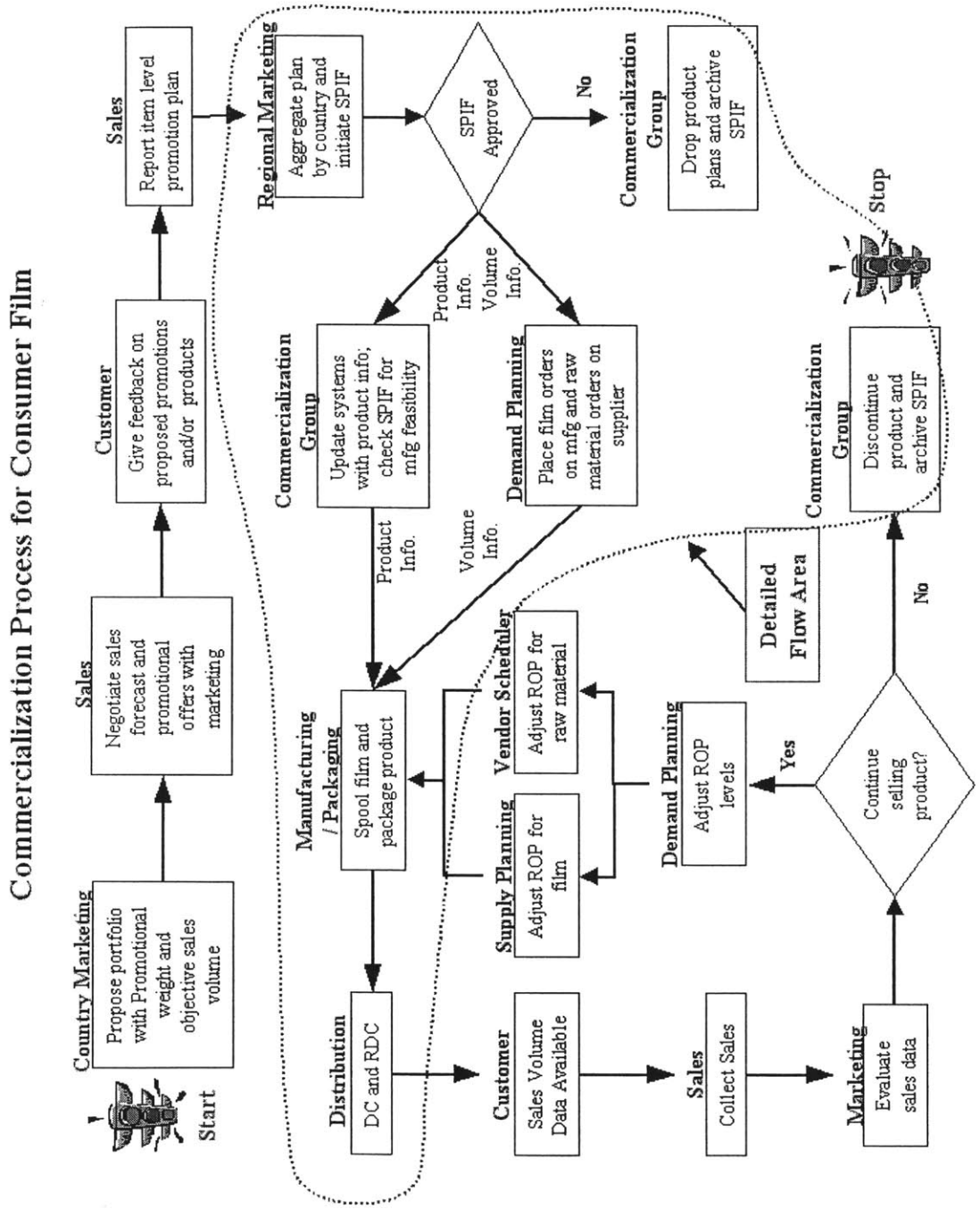

Figure 7: Commercialization Process Flow Map with Area of Focus Circled

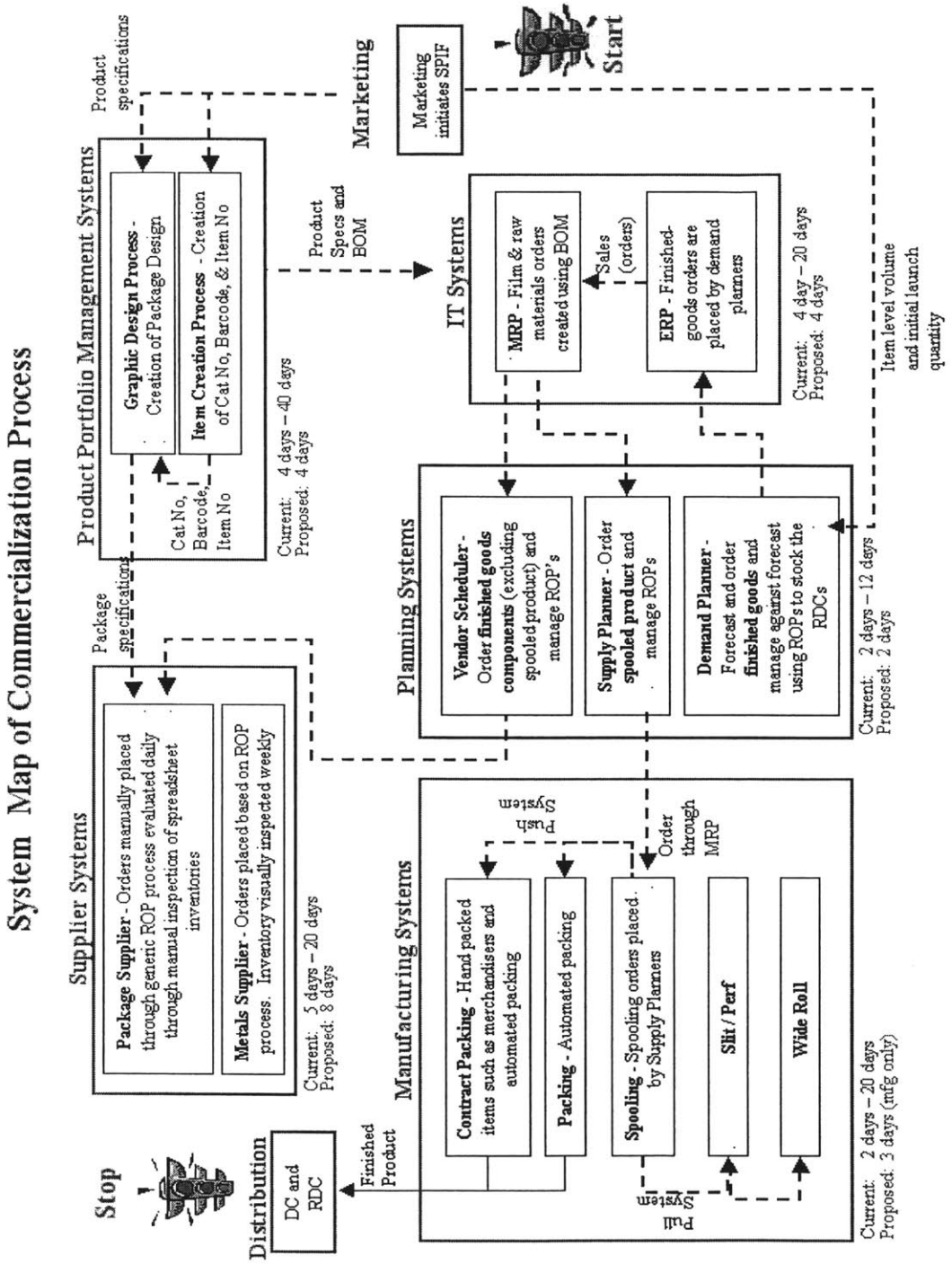

Figure 8: System map of Commercialization Process

There are five major systems within the system map: 1) Commercialization Systems, 2) IT Systems, 3) Planning Systems, 4) Supplier Systems, and 5) Manufacturing Systems. The following paragraphs give a high-level explanation of Figure 8.

After Regional Marketing approves a SPIF, product specifications in the SPIF such as film speed, exposure length, and carton concept design are passed to the Commercialization Group. An item creation person enters the product specification into a Lotus Notes database and then creates a catalogue number, barcode number, and item number for the new product. A graphic designer also receives the product specifications, which are entered into an Access database so that a job number can be created for graphic design. Using the concept design from Marketing, barcode data from item creation, and country specific regulations regarding package design (e.g. environmentally certified green dot), package design and graphics are created and submitted to Marketing for approval. Once Marketing has approved the package design, package specifications are sent to a supplier to be manufactured. The product specifications are sent to Manufacturing Resource Planning (MRP) system. Next, the Life Cycle Coordinators enter the item information into an Excel spreadsheet so that they can begin managing the life cycle of the product. The item creation and graphic design process can vary by as much as two-weeks (Note: All times given in Figure 8 are disguised)

Simultaneous to the item creation process, volume information is passed to Planning, where the demand planner aggregates the film volume, launch quantity, and launch timing into a planning software system. This information is used to plan manufacturing capacity at a high-level and does not include item-level forecasts. Volume information (based on the initial launch quantity) and product specifications (including the BOM) are then fed into the ERP and MRP systems. The MRP system then places

bulk film orders on manufacturing through a supply planner and raw material orders (primarily cartons) on suppliers through a vendor scheduler. The package (i.e. carton) supplier receives volume information from the vendor scheduler and package specifications from the graphics department and manufactures the appropriate amount. After the cartons are manufactured they are sent to the film manufacturing location where the cartons are packed with the spooled product and become a finished good. Finished goods are then sent to distribution. The entire process can vary by as much as six-weeks.

3.1.6 Identify Improvement Opportunities

In the Project Motivation section on page 31, problems in the commercialization process were illustrated through several examples including less than optimal incentive alignment, process compliance, process standardization, data integrity, and information sharing between departments. By looking for poor and/or unstable communication links, duplicate efforts, information gaps, and entry points for erroneous information, the process of creating the map in Figure 8 helped pinpoint eight potential of improvement opportunities. The first and most obvious improvement opportunity was to standardize and communicate the commercialization process. The second opportunity was to standardize new product introduction times. The third opportunity involved linking the graphic design process to the item creation process. This was because the graphic design process could not be completed until it received the barcode from the item creation process. Long lead-times (seven times that of the item creation process) made this hold-up particularly harmful because any graphic delays significantly impact on-time product launches.

The fourth opportunity was also somewhat obvious and involved reducing the sources of portfolio data. The fifth opportunity involved creating a system that could take into account and relate excess promotional volume demand to available manufacturing capacity. The sixth opportunity was to reduce the annual amount of

wasted raw materials. The seventh opportunity was to reduce waste caused by producing initial volumes of new product greater than predicted demand. The final opportunity was to reduce the amount of inventory kept in the warehouse of the contract packer. Improvement opportunities were not found in the map itself but rather in the process of creating the map. Figure 9 shows the system map presented earlier with callouts highlighting the locations of the eight improvement projects.

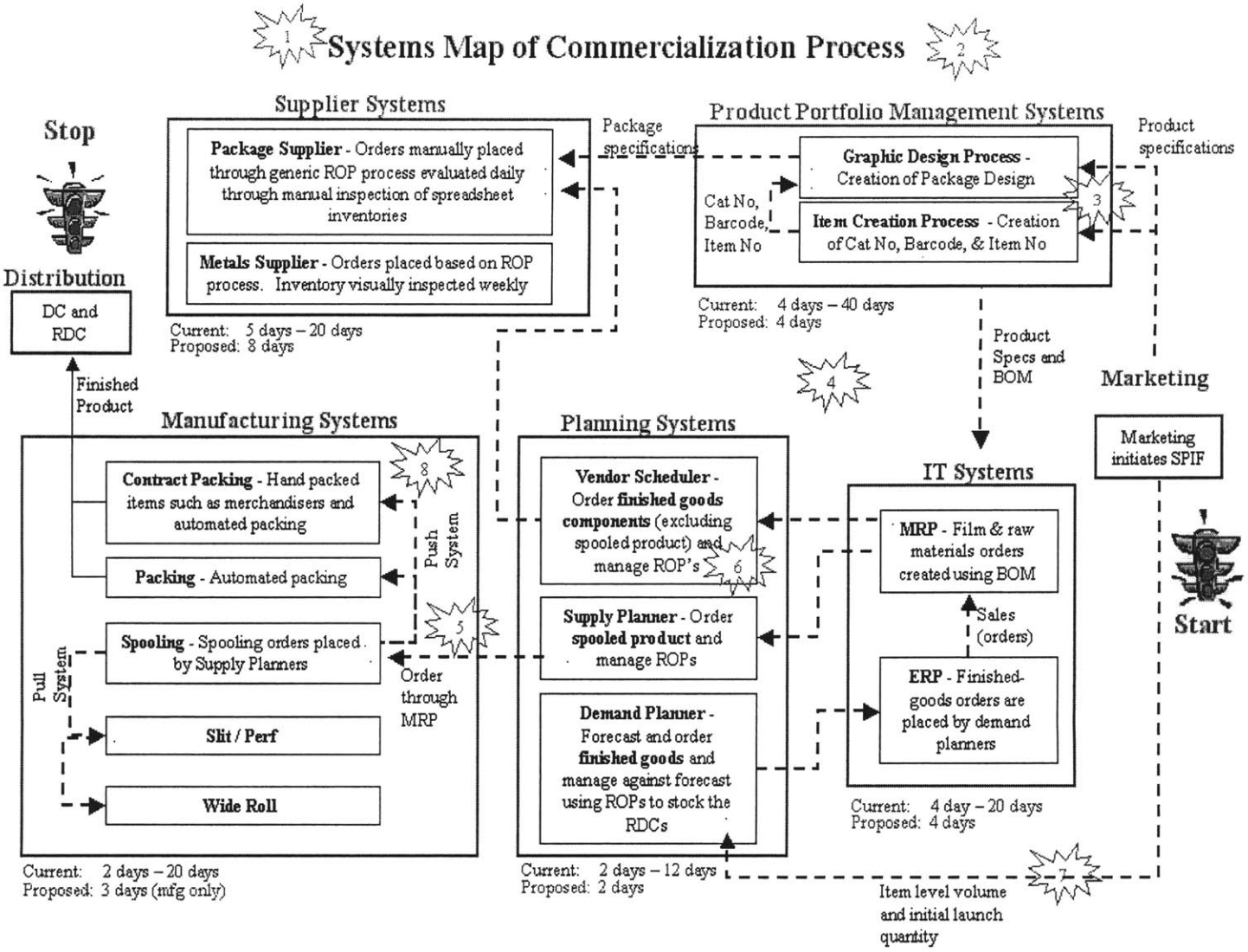

Figure 9: System Map with Highlights of the Eight Key Solutions

3.2 Identify and Implement Solutions

3.2.1 Supply Chain Solutions

There are basically three types of supply chain solutions: 1) process understanding and analysis can be used to eliminate waste, 2) models can be used to find optimums, and 3) IT can be used to increase visibility up and down the supply chain (Graves, 2002). Most outcomes, however, can have several solutions but again there is no cookbook that aligns a particular problem with a particular solution. A good rule of thumb is that a solution should contain both processes and systems. For example, if a new IT system is implemented, then the processes that govern how that system runs should be updated to reflect the change. Otherwise, the solution is likely to fail. Regardless of which method is chosen, decisions must be made regarding the level of standardization and communication of processes, the level of process versus system solutions, and the methods for implementation.

Process understanding and analysis is a solution type aimed at solving supply chain problems through standardization, simplification, and continuous improvement. For example, Lean Manufacturing is a way of thinking and consists of a set of rules and behaviors that define how organizations should make decisions and eliminate waste. Toyota has been a master of these techniques for years and prefers simple process solutions to complex models and IT solutions. Common tools used in Lean Manufacturing are Six-sigma, Kan-ban, and Just-in-time.

Benveniste and Morad (2001), on the other-hand, claim that supply chain has given rise to an even greater need for models to help understand, optimize, and control its various elements. They also say that the use of models, often quite sophisticated, has proved to be of great help in advancing supply chain management. Operation Research and Management Science (OR/MS) literature contains numerous examples of such

models and applications such as optimization, decomposition, stochastic programming, heuristic routing and scheduling, forecasting, simulation, and other hybrid approaches. All are combined with managerial experience and insight.

A substantial increase in computing power coupled with relatively inexpensive PCs, has given rise to mounds of company data. Information technology solutions such as Enterprise Resource Planning (ERP) capitalize on this data abundance by helping firms manage transactions and turn the data into useful information. Many companies such as SAP, Oracle, Baan, and PeopleSoft sold ERP systems to virtually every Fortune 500 company during the past ten years (Escalle, 1999). Of course an IT solution does not have to cost millions of dollars, it should just increase visibility up and down the supply chain. For instance, an integrated database was created at Kodak to increase communication and visibility of product portfolio data using standard Microsoft products such as MS Sequel Server and MS Visual Basic for only a few thousand dollars.

3.2.2 Project Solutions

To find solutions to the issues outlined above, a solutions list was created by generating a list of the gaps and inefficiencies that were causing the issues and then narrowing that list to core problems by applying a root-cause analysis (ask why five times). Next, each problem was listed with its impact and a goal for solving it. The list was shared with all stakeholders to determine the importance of each specific problem and to build support for the solutions. Research was done to determine if anyone else was working on the same issue. If so, an effort was made to team up with these people or to hand-off part of the project. Interviews were held again to determine if other people agreed with the assessment of the problem and the recommended solutions. If support was not evident for a particular solution, an effort was made to ask for resources and/or direction so that a proper solution could be found. Figure 10 contains the details of the solutions.

Although several projects were identified, it was not possible to complete all of them alone. Therefore, a Kodak team was formed to tackle the improvement projects and generate feasible implementation plans. Having many people involved in the implementation not only ensured that the problems were solved but also that the solutions would succeed after the internship was over. Interns tend to come up with really good plans but if the people who are left behind to do the work haven't bought into the plans or don't understand the solutions as well as they thought, the project could quickly lose momentum and die.

The eight improvement opportunities were grouped into three themes. The first focuses on standardization and documentation of the commercialization process. A lack of standardization was causing information delays, which led to the incentive problem seen between those who introduce and those discontinue products to and from the portfolio. It also brought about poor and untimely communication between departments, which led to waste in manufacturing capacity and raw materials.

The second theme concentrates on standardized and shortened product introduction lead-times. Variability in introduction lead times causes poor scheduling of product launches (especially promotions), blind manufacturing capacity commitments, and imperfect order fulfillment. Unpredictability and variable lead-times are also the reason that certain groups such as Marketing try to bypass the commercialization process by reusing catalogue numbers.

The third theme focuses on the creation and implementation of an integrated database for managing the product portfolio and performing valuable analyses that would increase the speed that product information flows through the company. A properly integrated database would significantly improve data integrity and reduce waste caused by poor and untimely information transfer.

Because the integrated database was the most technically complex issue and had the largest potential impact, it is where most of the subsequent project research was focused. Therefore, the next section is dedicated to discussing the Portfolio Database solution.

List of Improvement Projects

1. Commercialization process not standardized nor communicated.

- **Impact**: Low visibility of the data used in the process and the commitments, leads to unpredictability in order fulfillment.
- **Goal**: Implement a formal, gate based process based on standard committed lead times. Pilot November 01, implement 1Q02
  Implement supporting metrics :
  - Reliability : 1st quantity at customer location
  - Robustness : % process violations

2. Product introduction process is too long and variable.

- **Impact**: Creates information delays which lead to excess inventory and waste.
- **Goal**: Drive standard introduction process down 60% (non-standard introduction 50%). Eliminate variation in product introduction times due to process, standardization, and communication issues. Document standard lead-times for product introductions.

3. Item Creation Process and Graphic Design Process not linked

- **Impact**: Unbalanced workload in Packaging Services Group and unpredictable output from the Portfolio Management Systems box.
- **Goal**: Link start times for SPIF process and Graphic Design process to create predictable output.

4. Many portfolio systems/tools exist that do not communicate with one another.

- **Impact**: Erroneous data, redundant data entry and poor communication between manufacturing, marketing, planning, and corporate about actually portfolio.
- **Goal**: Implement a standard database to support data consolidation. Pilot August 2001, implement 1Q02.

5. No tool to relate demand to available capacity.

- **Impact**: Capacity planning does not include all relevant data, which leads to poor scheduling of promotions, blind Manufacturing commitments, and imperfect order fulfillment.
- **Goal**: Implement a promotion scheduling board fed by planners input. Translate it in load forecast for Manufacturing. Make it visible and shared.

6. Thousand of dollars wasted in carton supplies annually.

- **Impact**: Huge waste in manufacturing capacity, materials and warehouse space.
- **Goal**: Revise carton ROP's, standardize communication between portfolio management and carton planner, implement an effective end of promotion gate with elimination of obsolete inventory

7. Pre-promotional launch quantity too high

- **Impact**: Excess inventory, increased risk of scrap, bottleneck on Manufacturing schedules
- **Goal**: Implement a post launch review of actual sales (Nov 01), use history and demonstrated replenishment lead times to support better estimates.

8. Pack Center has excess packaging inventory

- **Impact**: Large inventory holding costs, inappropriate allocation of manufacturing resources, large amounts of scrapped material, poor customer service.
- **Goal**: Reduce supplier lead times, eliminate all off site warehouses, and reduce inventory by 75%.

Figure 10: Solutions List for Improving the Commercialization Process

3.3 The Integrated Database Solution

One of the original project objectives was to build an integrated database that could be used as a single point of data collection and review by all parties (instead of current ten plus spreadsheets and systems). The objective was initiated because the existing method for managing portfolio data was thought to be insufficient. This was implied during the interview process at a high-level when multiple people described a situation where Corporate Marketing, Finance, and Supply Chain all claimed that EAMER had more products in its portfolio then it claimed. Unreliable data was noted again at a lower level, when several people from EAMER showed up to a meeting to discuss the product portfolio and all had different information from different data management systems. The insufficiency claim was supported during the creation of the system map, which revealed that there was no database that contained the entire product portfolio (i.e. the true size of the EAMER portfolio was unknown).

Creating an integrated database was seen as a critical piece to improving the commercialization process, bringing visibility of the product portfolio to the organization, and eliminating waste caused by time delays, erroneous data, redundant data entry, and poor communication between Manufacturing, Marketing, Planning, and Corporate. A successful solution required that the database replace, complement, and/or support the plethora of existing databases used to manage the portfolio. This mandated that the database have a user-friendly interface and would easily allow any client to manipulate the portfolio in a way that turned data into useful information (e.g. provide insight into products that aren't selling well and/or products that could be consolidated). Furthermore, the database should increase the visibility of information and the speed in which that information is transmitted. The Portfolio Database corresponds with callout number four on Figure 9 (specific description given in Figure 10 - Bullet 4). The timeline was to have a prototype by August of 2001 (two-months into the research

project) and to have a fully functional version implemented by end of the first quarter of 2002 (three-months after the end of the research project).

3.3.1 What is the Portfolio Database

The Portfolio Database (DB) is a homegrown piece of software, developed by the author and a professional consultancy company in England. The primary beneficiaries of the Portfolio DB are Marketing, the Commercialization Group, Planners, and Management. Custom and standard reports allow users to manage the product portfolio in an efficient and reliable way. Multiple security levels and validation rules allow several users to view and modify data simultaneously without sacrificing data integrity. The database has a specially designed product hierarchy that allows users to view, sort, and filter data in a variety of ways that are useful and relevant to their individual needs.

The majority of portfolio data is semi-manually input by the Commercialization Group to guarantee that the most up-to-date and accurate information is available. To ensure that the Portfolio DB remains in agreement with the ERP system, various extracts such as sales, inventory, and SKU statuses are regularly imported from InfoSys and exception reports run to find discrepancies between the two systems. The Portfolio DB not only contains ERP data but also non-ERP and country-specific product data. Because it is the only system to contain details from every country, it is the most accurate reflection of the EAMER product platform and has been declared the official European portfolio from which tactical and strategic decisions can be made. Appendix A contains more information about the Portfolio DB including screen shots showing how the database is used, a description of the product hierarchy, and an overview of the system requirements.

3.3.2 Why not use InfoSys

One of the greatest obstacles facing the Portfolio DB was the question "Why does EAMER need to have a database in addition to the ERP system, InfoSys, to manage the European product portfolio. Some argued that InfoSys is the master data system and should therefore be the official portfolio. However, three main reasons were found that supported the idea of having a system outside of InfoSys to manage the portfolio. The first and most obvious reason is that not all countries use InfoSys, therefore, InfoSys does not have all of the data. The second reason is that InfoSys is not forward looking (i.e. it only reports 'what is' and not what will be). The third reason is that InfoSys does not contain the filter capabilities necessary to perform everyday analysis on the product portfolio. In the following paragraphs, each of these reasons are discussed and expanded upon.

Not all countries are on InfoSys: Because not all countries are using InfoSys, there is an inherent need to track the portfolio for those countries in another system. A possible remedy would be to track some products using InfoSys and others using a different system. This is neither practical nor desirable because it would require constant fluctuations between the two systems and would reduce visibility to potential consolidation efforts between ERP and non-ERP countries. The only practical solution is to develop an integrated database that communicates with InfoSys and can be used by any country regardless of its ERP capabilities.

InfoSys is not forward looking: One of the most important tasks in portfolio management is managing the introduction and discontinuation of products. This requires that the portfolio managers understand present, past, and future portfolio modifications. InfoSys allows for present and past management, but not future. This restricts all analyses to historical data and/or snap-shots of the present situation. Users may,

however, need to know what the portfolio will look like at the end of the year and this would not be feasible using InfoSys.

InfoSys does not have the filter capabilities necessary to actively manage the portfolio: InfoSys has detailed descriptions and much information about each product including a sophisticated hierarchy. Unfortunately, these InfoSys descriptions and fields leave the user wanting when it comes to portfolio drill-downs and complex analyses. For instance, what if a user wanted to consider a product consolidation opportunity for multiple countries based on a cross-reference of carton languages, pack-styles, and sales volume. This would be impossible using InfoSys, but very simple using the Portfolio DB. The product hierarchy developed in the Portfolio DB is aligned with current business needs and organizational structure and can be easily modified to reflect any new requirements, thereby allowing users to dissect the data in a way that is practical and insightful to them under existing business conditions.

3.3.3 How the Portfolio DB was built

Step 1: Customers were interviewed to determine what systems were currently being used to manage the product portfolio, what the systems are used for, who maintains them, and the frequency with which they are updated. Table 3 shows the results of this interview process.

Table 3: Systems Used to Manage the Product Portfolio

User	System	Owner	Update Frequency	Purpose
Local/Country Marketing	Excel spreadsheets	Individual marketing representatives	As needed	Used to manage country level product portfolio including promotions and limited-time products
Regional Marketing	Excel spreadsheet	Compiled by local marketing	Quarterly	Used to report portfolio size and details to Corporate Marketing and find portfolio consolidations within the region
Demand Planning	InfoSys	Individual planners	As needed	Used to place orders on manufacturing
Commercial-ization Group	Excel spreadsheet	Life Cycle Coordinators	As needed	Used to manage the life cycle of products into and out of product portfolio
Manufacturing	MfgSys[13]	Manufacturing	As needed	Used to schedule production and order materials from downstream manufacturing operations (such as wide-roll)
Supply Planning	MfgSys	Individual planners	As needed	Used to order spooled film from manufacturing
Vendor Scheduler	Excel spreadsheet	Vendor Scheduler	Bi-monthly	Used to order raw-materials, such as cartons, from suppliers
Corporate Marketing	InfoSys	Planners	As needed	Used to compare regions to one another, manage company costs, and set strategic direction

[13] MfgSys is a disguised name for the manufacturing execution system (MES) at Kodak

Step 2: The portfolio systems in Table 3 were put into the commercialization process map to find poor and/or unstable communication links, duplicate efforts, information gaps, and entry points for erroneous data (Figure 11). From the figure, we can see the reason for some of issues listed in the project motivation section. For example, tracing the flow of an introduction and discontinuation through the portfolio systems illustrates the incentive problem between those who introduce and those who discontinue products. When a product is introduced, information about that product flows from the Country Marketing spreadsheet(s) (CM spreadsheets), to the sales catalog, then to the Regional Marketing spreadsheets (RM spreadsheets), then to the Commercialization Group spreadsheets (CG spreadsheets) and InfoSys where the product enters status 3.

Commercialization Process for Consumer Film

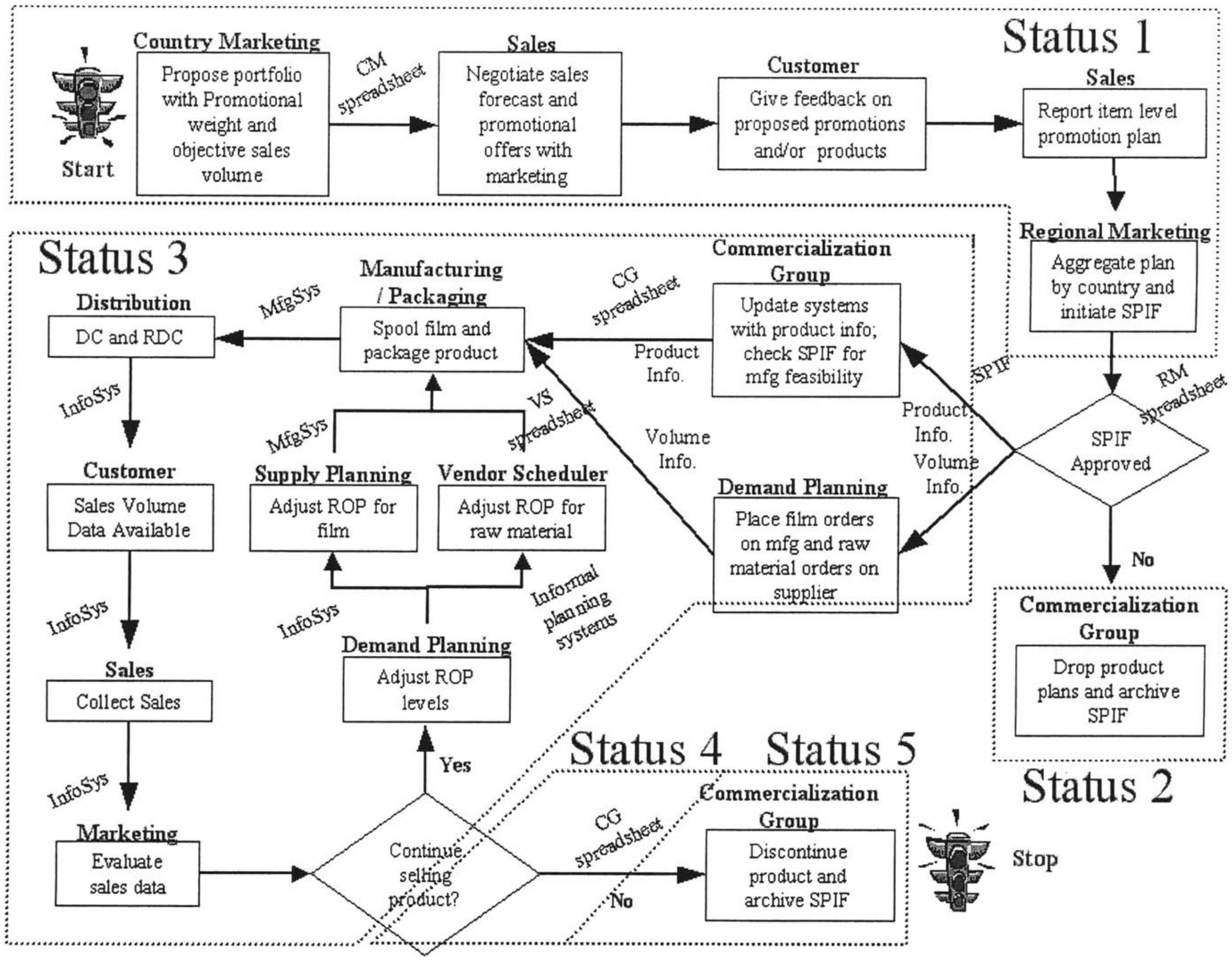

Figure 11: Commercialization Process with Existing Portfolio Systems

From the figure above we can also see that Manufacturing cannot produce any new products until it receives volume information, which comes from Demand Planning via InfoSys. From this flow of information, it becomes obvious how Marketing ensures that new product information always gets into the ERP system. For products that continue to be produced after the initial launch, re-order points are established in MfgSys for film and the Vendor Scheduler spreadsheet (VS spreadsheet) for raw materials. Again, Manufacturing cannot produce any products until it receives volume information for Planning (this time in the form of re-order points).

If Country Marketing decides to discontinue a product, however, not all of the systems get updated. Because the existing systems are not linked to one another (except InfoSys and MfgSys), status changes (i.e. movements in the product lifecycle) must be manually made in each of the systems. The Commercialization Group usually updates its spreadsheet when the product moves from status 3 to 4 (selling OK, not more purchasing). The Country Marketing spreadsheets will most likely get updated because Marketing initiated the event. There is no formal event, however, that ensures that InfoSys and MfgSys get updated. In a perfect world, the necessary communication will happen but in this situation there is an obvious information gap and entry point for error. The fact that there is no formal system causes the incentive problem noted earlier.

Another issue that can be seen from the map is that of information transfer between the Commercialization Group and the Vendor Scheduler. Even if all of the other systems are updated, someone must contact the Vendor Scheduler and have that person update the VS spreadsheet. The unstable communication link can sometimes cause information to be delayed or not delivered at all. In these instances, the Vendor Scheduler could mistakenly order raw materials for an item that has fallen below the re-order point but is no longer being sold. This is a cause of material obsolescence and waste in the EAMER supply chain.

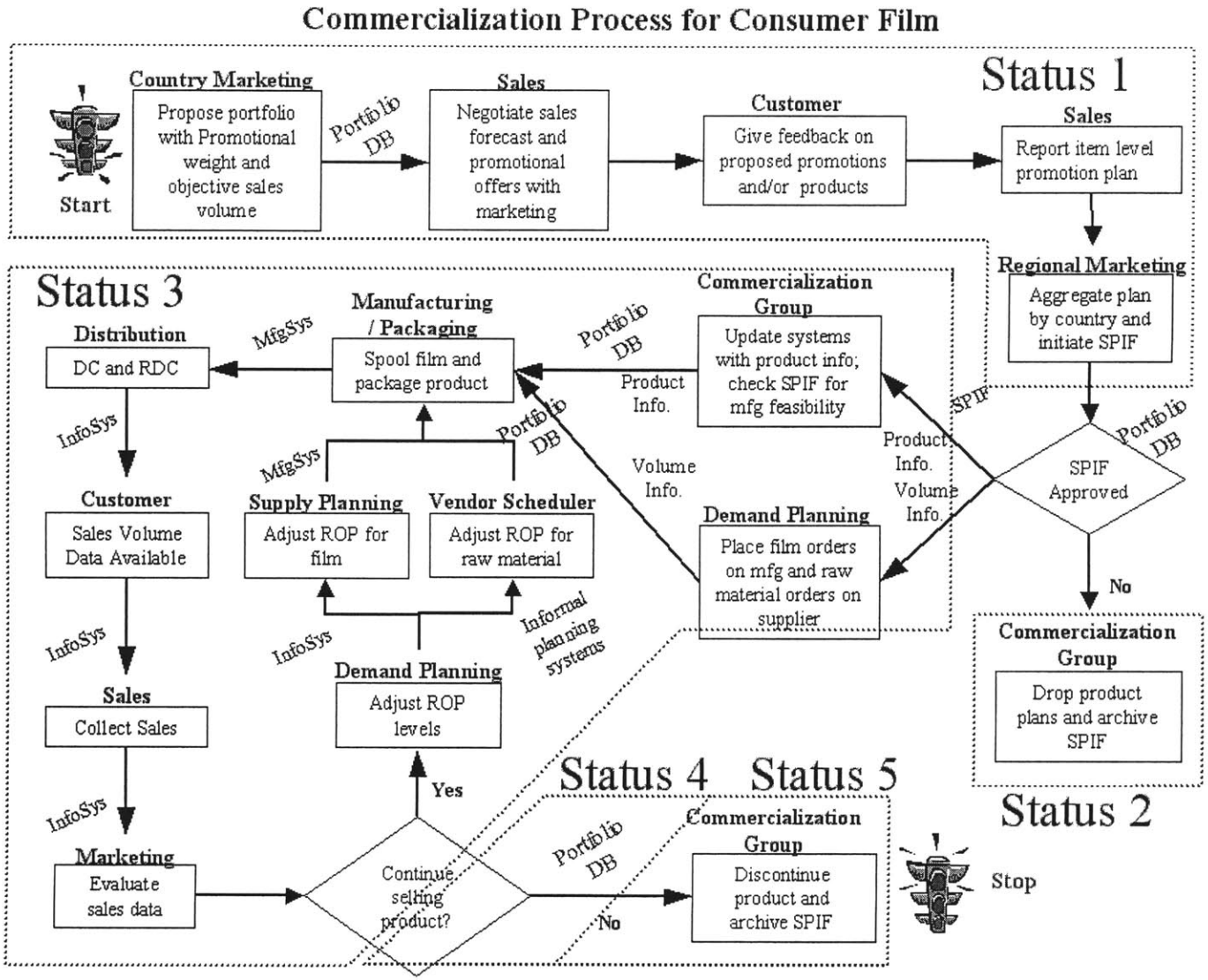

Figure 12: Commercialization Process with New Portfolio Database

Step3: A new map was built showing how the new Portfolio database would replace and improve some of the old systems (Figure 12).

Step 4: A prototype database was built in MS Excel to build credibility and act as a springboard to launch a professional version. After the prototype proved useful, permission was granted to hire a consultant to help design and build a proper database.

Step 5: A beta version of the database was built using MS Sequel Server and MS Visual Basic. It took four weeks to design and build the first version.

Step 6: The database was taken on a road show in Europe to get feedback from managers in the various departments that would be using the database. Up to this point, the benefits of the Portfolio database were mostly unsubstantiated. The road show created an opportunity to convince the unsure by physically demonstrating some of the features such as performing complex portfolio analyses that were very difficult and/or nearly impossible in the past. The road show was also used as a forum to gain feedback, which was then incorporated into future revisions. It is important to include as many people in the implementation as possible so that others are a part of the solution and create the necessary support.

Step 7: Implementation and proliferation. The professional version of the database was functional by the end of the research project but had only been installed on small group of computers. Testing within the Commercialization Group is expected to continue through the end of the first quarter of 2002. At that time, the system will be proliferated to people within Kodak who have a need to access the EAMER portfolio.

3.3.4 Benefits of the Portfolio DB

There are several benefits of the Portfolio database. The most obvious benefit is that it **adds the visibility necessary to globally optimize the product portfolio** as opposed to local optimization. The previous process did not allow multiple users on one system, each country had to manage its product portfolio on personalized spreadsheets. This not only limited the visibility of the entire portfolio to upper management but also prevented each country from leveraging the other's product portfolio. Providing country-to-country visibility increases potential cost savings by making consolidation opportunities more apparent at both a high and low level.

Second, because the Portfolio DB links the various commercialization systems together, it also **reduces the probability of communication delays and/or failures and allows many people to view data and make corrections simultaneously.** The implications of this go beyond multi-people getting into the system at the same time. It also means that instead of having to route information through several sources so that it can ultimately end-up on the Portfolio DB, it can happen instantaneously by the original requestor saving a lot of time, effort and money. Converting the database from any information source to a living document, however, will take time and commitment from all levels of the organization. For the time being, the responsibility of keeping the data up-to-date falls squarely with commercialization group. As time goes on, these responsibilities should be shared among the different groups that interact with the Portfolio DB.

A third benefit is **increased data integrity**. Prior to the creation of the Portfolio DB, managers were making decisions on incomplete or inaccurate information. The increased accuracy of the portfolio will now allow managers to make faster and better decisions about their countries and/or regions. It will also allow Corporate Marketing to

accurately compare one region to another to find best-in-class performance and create company benchmarks.

Fourth, the database **stimulated standardization of naming conventions.** Much of the information required (e.g. the speed and exposure length of the film, the country where the film is sold, and the package style), already existed but was maintained in separate systems or was not in a database friendly format. Between systems and within systems there were inconsistent naming conventions (e.g. France being referred to as Fr, Fre, and/or France).

Fifth, there were also issues with data being too finely defined or not being defined finely enough. For instance, carton styles were named based on its manufacturing design, which could include twin-pack with flap, twin-pack without flap, twin-pack with notch, twin-pack with double flap, etc. The lack of consistency in naming conventions **stimulated the design of a product hierarchy**, which was adopted by Marketing, Manufacturing, and Planning. See Appendix A for more information on the product hierarchy. Sixth, the Portfolio DB **ensures that the master data system (InfoSys) remains accurate** by running exception reports between the two systems, which can then be used to reconcile the differences.

Seventh, the Portfolio DB **protects data in InfoSys**. InfoSys is an expansive system containing data from many parts of the organization. In order to ensure data integrity and data efficiency within InfoSys, administrators must limit the number of users who can access the system. Not all people who need to access the product portfolio need to access InfoSys. In fact, only one of the five key persons who manage the portfolio on a day-to-day basis currently has a need to access InfoSys. So, even if InfoSys had the functionality and data required for managing the product portfolio, additional users would bog down the InfoSys system and reduce its own data integrity.

Finally, the Portfolio DB is a user-friendly tool that provides the users with the information they need when they need it. This will **increase the likelihood that users will keep the system updated**.

4 RESULTS AND CONCLUSION

The objective of this thesis was to propose simple method for discovering and resolving supply chain issues through the use of information flow mapping. The framework for this method included two major components. First, identifying supply chain problems through the use of interviews, site visits, organizational understanding, and information flow mapping. Information flow mapping not only helped me identify key areas for improvement but also brought a level of visibility to the process that had not been seen before. This visibility seemed to create more interest in the project and made the implementation phase much easier. Second, resolving supply chain problems through the use of models, process, and/or IT solutions. The introduction of the thesis mentioned that supply chain problems are sometimes more difficult because of implementation and/or organizational roadblocks than actual technical issues. Shoji Shiba (Shiba, 1993) said, "There are many good problem-solving methodologies. Sometimes the greatest challenge is not solving a problem, but finding the correct problem to solve." By spending time up-front, ensuring that you have chosen the correct problem and that you have proven to people that you understand the problem, you can avoid some organizational resistance.

Kodak did a fantastic job of aligning the research for this project with the strategic objectives of the organization and removing many of the roadblocks that one typically sees in project work. Everyone was interested in improving the product introduction/discontinuance process and having an integrated database that not only allowed Kodak to track their product portfolio accurately but also to perform insightful analyses. The beginning of research project also happened to coincide perfectly at the timeframe in which Kodak was beginning a major effort to optimize its European supply chain; as a result, the research project was an excellent fit. As part of the KOS initiative there was a frontal attack on the size of the product portfolio, which also created strong

alignment between the research project and strategic direction of Kodak. Because of this alignment, interviews were had with employees from every level in the organization, that would have otherwise been unlikely. The interviews provided valuable insight into Kodak European operations and helped build credibility and support for the project. Consequently, the research and implementation process went smoothly. Most supply chain projects, however, are not so lucky.

4.1 Successes

Much of the project was spent working on the Portfolio DB. The largest benefit came from the process of creating the Portfolio DB as opposed to its actual creation. For example, the process of integrating various databases used in the commercialization process revealed many products that were already discontinued but still in the system, products that should be discontinued but still in the system, and products that could be consolidated between countries. These opportunities helped Kodak reduce the size of the portfolio by 30%, which led to a direct cost savings of approximately $2,300,000. The value of carrying fewer inventories also created a significant ongoing cost savings of approximately $500,000/year. The process of creating the Portfolio DB also enabled the Commercialization Group to update the official master data system of Kodak, InfoSys, to reflect actual portfolio size.

Having the Portfolio DB also creates potential cost savings of several million dollars by allowing a single person to perform complex product portfolio analyses in a few minutes over what used to take several people several days to complete. Other successes include:

- Developed an integrated database that can be accessed from anywhere in the Kodak network
- Developed a documented commercialization flow

- Standardized product introduction times
- Raised confidence level of Europe's portfolio count from very low to almost 100%
- Implemented a prototype version of Portfolio DB in Russia/Greater Asia region

4.2 Shortcomings

Although the project was very successful in terms of completing the original project objectives, these are items that were planned to be implemented but did not get done by the end of the project:

- **Implementation**: Full implementation and proliferation of the Portfolio DB to EAMER marketing.
- **Server Location**: There are two types of servers at Kodak: development servers and production servers. There is no physical difference between the two server types except the rules that govern them. Because the Portfolio DB needed to be established in a very short period of time it was built on a development server. Getting access to a production server takes time and there are rules in place that dictate what kind of applications can be installed on production servers and who can maintain them. The portfolio DB will need to move to a production server at some time but can reside at its current location for the time being.
- **Pass down:** Most people, including myself, did not anticipate the number of last minute problems with implementing the database, so a proper pass down was not completed. For example, when trying to install the Portfolio DB on computers in France the database did not work. It was found that French and English

computers have different system component files, which affects installation. This only allowed for installation on one French computer before leaving.

- **Final presentation:** A final presentation was not given to Kodak because too much time was spent trying to work the "bugs" out of the Portfolio DB.

4.3 Lessons Learned

The following key lessons were learned during the project:

- **Building Momentum:** The foundation from which the Portfolio DB was built not only impacted the portfolio size but also significantly increased opportunities to eliminate waste in other areas. For instance, by simply adding a table that relates a known database field, such as pack-format, to a particular packing machine, you can easily determine impacts on manufacturing capacity as a result of changes in the portfolio.

- **Importance of good data:** Because Kodak European region did not have any real database from which to manage their portfolio, they could not make any significant headroom in discontinuing products

- **Simplicity works best:** The problem solving method and solutions to this project were very basic but had a large impact. The reason that a lot of supply chain projects fail is because they are too complex. The two information maps that were created for this project were used over and over again. The advantage of using these maps was two-fold. First they were developed in interview with the people whom the solutions would impact. This gives the solutions more credibility and makes implementation easier than it would have been otherwise. Second, by forcing yourself to relate all information to a map that is believed by

the organization to be accurate, you must challenge every piece of information you receive and take nothing for granted.

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6 APPENDIX A – THE PORTFOLIO DATABASE

6.1 Portfolio Database IT Requirements

6.1.1 System requirements

There are only two system requirements for the Portfolio DB:

- 1 Megabyte of free hard-drive space.
- Wide Area Network (WAN) or Local Area Network (LAN) access

Because the Portfolio DB is accessed remotely, a computer must be connected to a WAN/LAN every time it is accessed. There are no strict system requirements for processing speed and/or memory, however, the database does require data processing so faster PC's will respond more quickly.

6.1.2 Software requirements

The Portfolio DB is comprised of two pieces of software. The user-interface called the front-end and the database called the back-end. The front-end is built on a Microsoft Visual Basic platform and must be installed on each computer (1 Meg of free disk-space required). The database is built on a Microsoft Sequel Server platform and does not need to be installed locally as it remains on a remote server, which is accessed through the front-end forms via a wide-area-network (WAN).

The front-end Visual Basic program has been compiled into an executable file, which can be installed and run from each computer. Because the program is compiled, users do not need to have MS Visual Basic installed on their computers. Instead, all of the necessary dynamic link library files (*.dll) and Active-X controls (*.ocx) are installed when setup.exe file is run.

6.1.3 Software Installation

Because Kodak computers are run from a Windows NT platform, only a person who has administrative rights can install software on a computer. Therefore a request must be made to the local IT group to install the software. A process was established, however, that an administrator of the Portfolio DB would do this on behalf of the user. After a request for access has been approved by one of the Commercialization team members or the Commercialization Manager, the user's name, user ID and computer ID is sent to the local IT group along with the installation software. The local IT group can then remotely install the software on the requester's computer. As part of the installation program, an icon is installed on the user's start menu and gives direct access to the Portfolio DB.

6.1.4 Connecting to sequel server

Once the Portfolio DB has been installed on the computer there is no need to make a manual connection to the sequel server. The Portfolio DB initialization file 'Portfolio.ini' contains all of the necessary information for the computer to connect automatically to the server. However, if the server location changes, the initialization file, which is located in the Program Files directory in the Portfolio folder, will need to be updated. The Portfolio DB administrator must update the initialization file and e-mail it to all users who then must copy that file into a specified directory file. In the event that a change is necessary, a complete set of instructions will accompany the new initialization file.

6.2 User Types and Permissions

There are four user types: guest/unregistered user, registered user, owner, and super-user. Each user type has specified restrictions to the Portfolio DB capabilities, which are outlined in following sections.

An unregistered user is defined as someone who is registered as a 'view-only' user or someone who has access to the Portfolio DB but is not 'registered' at all and therefore must sign-in as a guest. Unregistered user's have the lowest level of permissions and can therefore only view data. Any person who has a need or interest to view the product portfolio but will not make change requests should be classified as an unregistered user. Examples of these types of persons are managers, planners and manufacturing.

The major difference between unregistered and registered users is the fact that registered users can request changes to the database using the menu option 'Modify Product Data' or 'Add New Cat.No.' while unregistered users can only view the data. Giving users the ability to make change requests is perhaps one greatest features of the Portfolio DB tool and will significantly increase the accuracy of the portfolio while simultaneously decreasing the amount of work required to maintain it. This feature enables users who have specific knowledge about particular products to not only view relevant data but also make corrections and/or changes.

Super-users do not have any restrictions to the database and can modify any table, query, report, and/or relationship. However, in order to make these types of modifications, the user must have Visual Basic installed on their computer. Because a super-user has so little restrictions in the Portfolio DB, very few people will have super-user privileges. Super-users should have strong programming skills in Visual Basic and an understanding of MS Sequel Server.

6.3 Product Hierarchy

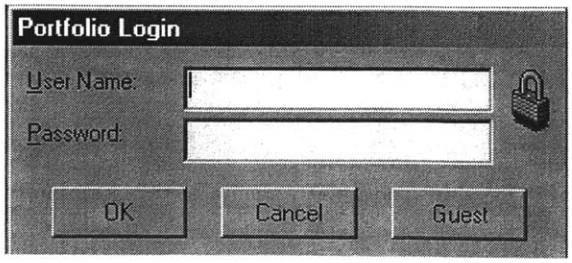
The hierarch of the Portfolio DB is structured to maximize users abilities to analyze the Portfolio. The following bullets detail the hierarchy and list example items under each.

- Product Family: CI Film, KP Film, OTUC, Merchandisers
- Status: Current and future are
    - Status 1: Item in planning
    - Status 2: Plans dropped
    - Status 3: Live item (Purchasing of raw material and Selling OK)
    - Status 4: Planned for discontinuance (No purchasing of raw material, selling OK)
    - Status 5: Item discontinued (No purchasing of raw material and no selling)
- Marketing Strategy: Strategic (longer than six months), Tactical (less than six months), Intermediate (not a finished good), Non-EAMER (product sold in a region other than EAMER)
- Product Class: 110, 120, 135, APS, etc…
- Product Subclass: APS, Elite, Gold, etc…
- Speed: 100, 200, 400, etc…
- Exposure: 24, 27, 36, etc…

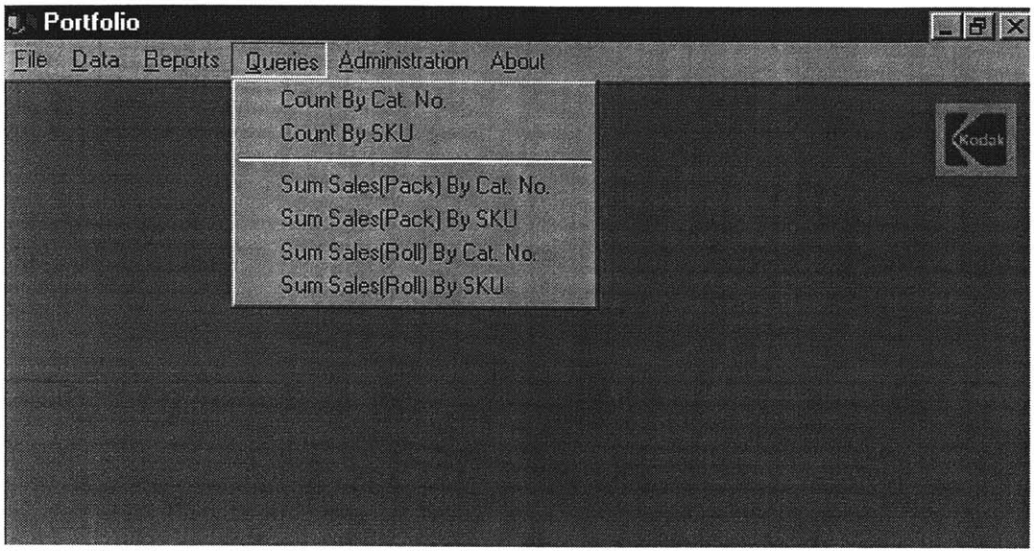
6.4 Using the Portfolio DB

The name of the Portfolio DB program is Portfolio.exe and an icon can be found on your desktop or in your Start Menu under Programs then Portfolio. The icon looks like a roll of film as shown to the right: 

Click on the icon and a login screen will appear as shown to the right. Type in the user name and password that was sent to you by a life cycle coordinator and click 'OK'. If you have not received a user



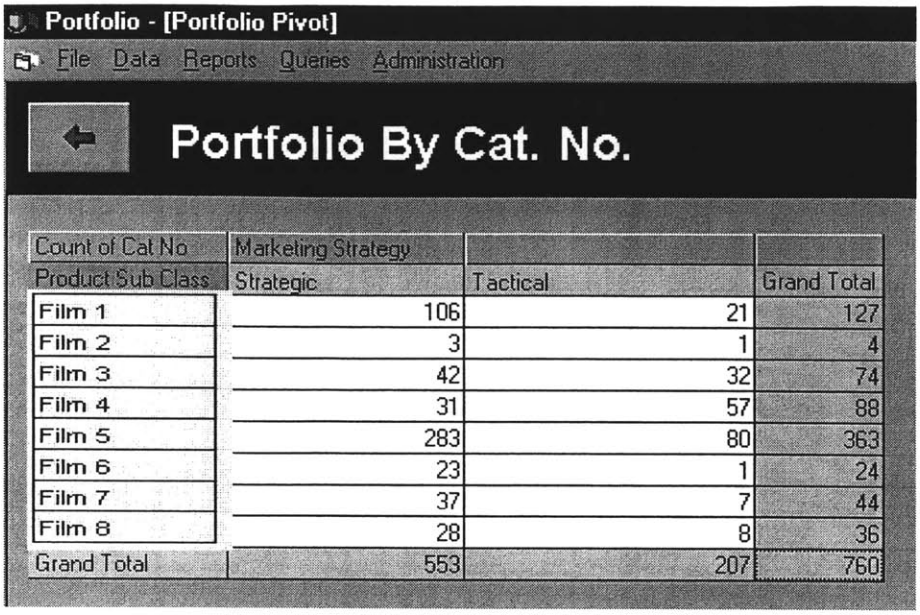
name and password from a life cycle coordinator, contact the commercialization manager. After you have logged in, the Portfolio will open to a blank screen. Use the menu bar at the top of the screen to select an option. For example, if you choose the menu option 'Queries' the screen would like the one shown below.



Depending on your security level, different menu options will be available to you. The following paragraphs outline the different user types and their respective permission levels.

6.4.1 Viewing Data

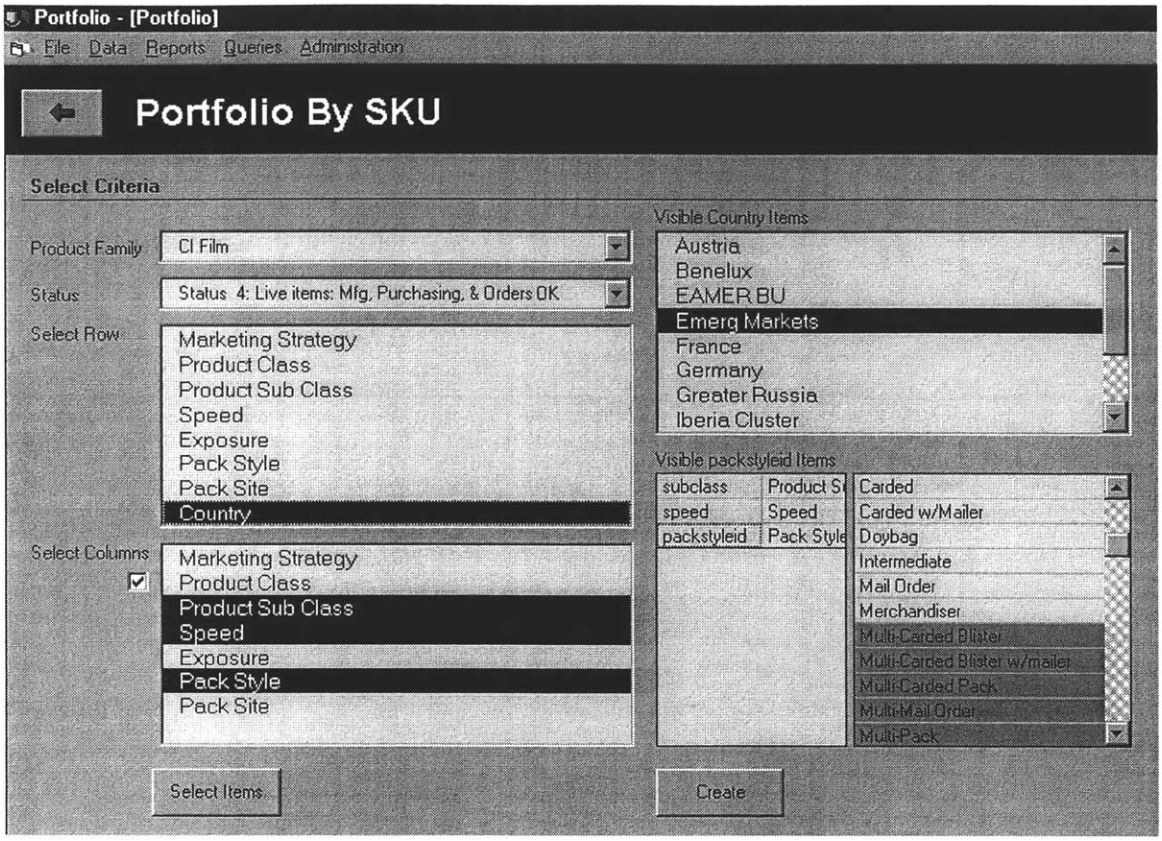
There are several standard reports in the Portfolio DB including Catalogue/SKU counts, sales volumes, and inventory levels. Standard reports can be complex analyses such as determining the number of catalogue items that make up 80% of the sales volume or they can be simple cross-tab reports. Below is a screenshot of a simple cross-tab report that shows the Catalogue Number count by Product Subclass by Marketing Strategy.



Count of Cat No	Marketing Strategy		
Product Sub Class	Strategic	Tactical	Grand Total
Film 1	106	21	127
Film 2	3	1	4
Film 3	42	32	74
Film 4	31	57	88
Film 5	283	80	363
Film 6	23	1	24
Film 7	37	7	44
Film 8	28	8	36
Grand Total	553	207	760

Double clicking a particular cell of a cross-tab report, like the one shown above, reveals further details about the particular catalogue numbers that comprise that cell. For example, the table above indicates that there are 21 tactical APS catalogue numbers. Double clicking on the number '21' would reveal the specific details of those cat no's.

In addition to standard reports, users can analyze portfolio data using custom queries. These queries allow users to drill-down into the data by narrowing search results with sophisticated filtering tools. This gives users access to very specific subsets of data, which is sometimes necessary and more practical. For example, if a request was made to determine the CI Film SKU count for Emerging Markets by exposure for all multi-pack, Gold, 400-speed film that are currently status 4 (live) items, a user could easily generate this report using a custom query. Below is a screen shot that shows how the filter tools could be used to create this query.



6.4.2 Exporting Data

The Portfolio DB allows you to export most of the data that can be seen to MS Excel. To export the data simply click on the export button located on the left of screen. The button looks like this:  . If an export button is not visible, then the particular data on the screen cannot be exported. After the button is clicked a save dialog box appears asking the user to choose a location and to name the file. The file is saved as a comma separated-value file (*.csv), which can be opened in MS Excel.