A Method for Consolidation of Raw Material Purchasing Specifications To Achieve Quality Improvement and Leverage Spend In a Global Food Company

by

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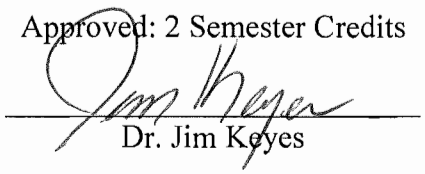

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Abstract

Globalization has significantly influenced the distribution of the world's food supply. There were now greater opportunities to procure raw material supply. However, with recent food industry scandals, an increased pressure was placed on food manufacturers to ensure high quality raw materials were used to produce safe products for consumers. This paper discusses a global food company's approach, to improve the quality of the raw materials used for food manufacturing, while also consolidating the purchasing specifications. The key area of focus was the commodity dairy proteins as these were important to the quality of the finished products. This consolidation and quality update was achieved through SAP, as this was used company-wide for raw material data and purchasing specifications. The purchasing specifications became centrally managed while the requirements were standardized, reducing the inconsistency amongst specifications. Through this project, the number of purchasing specifications was

reduced and more volume was purchased from a single specification. As predicted by the literature, centralizing the specifications and consolidating the requirements, reduced the duplication of work, the inconsistencies between specifications, and brought further ownership and responsibility to one group. It also brought global visibility and envisaged more efficient future specification updates when required by the business.

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Chapter I: Introduction

Globalization has quickly spread to the world food supply. Many countries have used the world's immense transportation system to transport goods for food manufacturing from various parts of the world and the gap between consumption and the location of production has vastly grown (Lambin & Meyfroidt, 2011). According to the Food and Agriculture Organization of the United Nations (2010), the world trade in food commodities has increased five times since 1961 and this has continued to increase due to globalization (as cited in Lambin & Meyfroidt, 2011). By opening up the world food market, more supply options and more export options were available, which lowered the overall cost of goods due to global competition. However, with securing supply at lower costs, it was a challenge to ensure that high quality goods were procured.

Longer supply chains have been a result of food globalization and presented difficultly in tracing raw material origin and ensuring that high quality raw materials were purchased (Kaditi, 2011). "Regulations might differ across countries, as countries have different type of regulations, different levels of tolerance for food safety risks, different costs of producing safer food, and different levels of accidental contamination" (Mitchell, 2003, 149). Additionally, with the increased number of free trade agreements, especially amongst countries with different standards, the door opened for importing unsafe goods (Hemphill, 2009). Consumer health should not be sacrificed for free trade agreements, thus purchasing high quality food products for manufacturing requires consistent standards, regardless of sourcing markets, manufacturing locations, market volatility, and supply chain webs. Additionally, food industry incidents such as poor hygiene, deficient microbiological testing, sanitation issues, and contamination or deliberate adulteration, have put more focus on the quality of goods. While regulatory bodies such as the

Food and Drug Administration (FDA), Codex Alimentarius Commission, and European Union exist, the number of regulators was insufficient to control the entire world food supply; In the United States, 90-95 % of imported food products were not inspected. Thus, independent companies have taken a proactive role in defining and monitoring food safety and quality requirements. Greater responsibility was on the private sector to set standards and monitor food safety. Any food safety recall has the potential to damage the reputation of a food manufacturer. Additionally, previous food safety recalls have harmed consumer confidence in the safety of the world food supply (Zubko, 2008)

One of the most important raw material groups for food manufacturing has been dairy proteins. Dairy proteins, formed by further processing milk, consist of milk proteins, caseins, whey proteins, and other various derivatives (Jost, 2007). Dairy proteins contain many vitamins and minerals that have proven essential for human development as well as overall health. When used in food manufacturing, dairy proteins have contributed significantly to finish product label claims. However, dairy proteins have been susceptible to contain contaminants due to pollution, human adulteration, pesticides, and veterinary drugs. Thus, the quality of the milk used to produce dairy proteins must be of high standard.

Dairy protein trade has typically occurred on a global scale. Many countries have imported milk or dairy proteins if the milk production was insufficient in its own country and countries with excess milk production exported the milk or dairy proteins (Jost, 2007). Milk consumption has continued to grow in some parts of the world, especially Asia and Latin America, which has driven milk prices higher. Following basic economics, food manufacturers have bought large quantities at low prices to secure raw material supply at a competitive price. Additionally, committing to high volumes has assisted sourcing during times of tight supply.

Therefore, the importance of understanding the dairy market and the development of high quality raw material requirements was needed from a quality and procurement perspective.

Problem Description

World Foods was a global food manufacturer, with manufacturing factories, research and development, and technology centers located throughout the globe. For confidentiality purposes, the company name of "World Foods" has been designated to replace the real company name. World Foods has implemented an enterprise resource planning (ERP) system, SAP, globally. One facet of SAP, was to house the raw material purchasing specifications for the raw materials purchased by World Foods. When each World Foods market implemented SAP, all of the raw material purchasing specifications from the legacy system were input into SAP, resulting in duplicated purchasing specifications. Multiple purchasing specifications existed for the same raw material, but many were missing key data and had different requirements, as each specification was based upon local standards. Not only was this seen across the company, but also amongst each division.

One division of World Foods, the Health Division, developed a project to reduce the duplicate raw material purchasing specifications, and to bring consistency and higher quality requirements to the specifications. The division of "Health" has been assigned instead of the real division name to protect confidentiality. Procuring against multiple purchasing specifications of different quality for the same or similar raw materials was cost prohibitive and inefficient. More so, it provided a conflicting set of standards and an inconsistent approach to the development of the purchasing specification requirements. This inconsistency and confusion sent a mixed message to the raw material suppliers, indicating that World Foods did not know the purchasing specification requirements for the raw materials. The primary intended consumers of the Health

Division products were ones with developing or compromised immune systems, thus raw material quality was of vital importance. However, this was not translated clearly in the specification requirements across the division. Additionally, the raw materials used for these products should be of similar quality, regardless of the manufacturing location or the finished product distribution markets, as the intended consumers had the similar health concerns and risks. While the World Foods Health Division project covered all raw material categories, this study specifically focused on the commodity dairy proteins.

Statement of the Problem

This study developed an approach to consolidate dairy raw material purchasing specifications, while improving the quality of the specifications used by World Foods Health Division in the United States. World Foods Health Division required the project be completed by the end of 2010, targeting a two-year project scope.

Purpose of the Study

The purpose of this study was to develop an approach to consolidate the dairy raw material purchasing specifications, while improving the quality of the specifications. This project was needed as World Foods Health Division purchased many of the exact same or similar raw materials from the same suppliers, but through different purchasing specifications with different sets of parameters. Thus, World Foods gave the suppliers multiple specifications for the same raw materials with inconsistent requirements. Consolidating and improving the quality of the specifications, streamlined procurement and quality functions for both World Foods and its suppliers. It also eliminated waste. Potential cost savings was available due to leveraged purchasing power as consolidated specifications have increased volume associated with each specification. Overall, this project ensured all dairy specifications were of utmost quality, which

translated into a stronger confidence in producing high quality finished products, and the opportunity to maximize on leveraged purchasing power.

The purpose of this study was achieved by the centralization of the specification development and consolidation activities. Previously, this process was decentralized and each market was responsible for its own purchasing specifications, which included all development and maintenance activities. With the implementation of this project by World Foods, three technology centers were now responsible for all activities related to the raw material purchasing specifications. The responsibility was divided by raw material category, and each technology center handled the raw materials that were in their area of expertise. One specific technology center was responsible for the dairy proteins.

The goal of this study was achieved through the determination of the base-line status as well as the implementation of a few new business practices. First, a list was extracted of all active raw material purchasing specifications used by the Health Division in the U.S. and it was sorted for the dairy proteins. The raw materials were purchased from a material number, which was linked in SAP to a corresponding purchasing specification. The list of purchasing specifications detailed the ones that needed to be addressed and this list was considered the baseline for the entire project. This list was maintained in Excel, was updated on a daily basis, and was used as a tracking tool for the purchasing specification consolidation activities.

A new divisional directive was issued indicating that all new purchasing specifications must be created by the responsible technology center and the markets had to contact the technology centers for any purchasing specification needs. This was to ensure that new specifications were not created by the markets or that duplicate specifications were not created for similar raw materials. All responsibility of developing and revising raw material purchasing

specifications was now a centralized practice. Additionally, all markets were requested to cooperate with the consolidation efforts. This step was vital to ensure the project was successful. Otherwise, the specifications would have to be continually revised or further consolidated instead of developing and consolidating the specifications up-front through a centralized process.

This approach was expected to benefit World Foods Health Division for many reasons. This division was now in a better position to respond to urgent crises related to the quality of raw materials. Specification updates were now quickly completed due to the centralized responsibility for specification maintenance. All of the specifications used by the Health Division were under the portfolio of one group. This brought visibility to the specifications used within the division, allowed for standardization of requirements, and foreshadowed future consolidation possibilities, as the technology centers had better knowledge of the exact raw materials, specifications, and suppliers used. Additionally, the division utilized spend better and had further opportunities to leverage purchasing power by using consolidated specifications for similar materials. Purchasing saw a reduction in the number of specifications and had increased volume from each individual purchasing specification, and thus optimized buying power.

Assumptions of the Study

This study assumed that similar dairy proteins and suppliers were used throughout World Foods Health Division, but from different purchasing specifications. This information was easily known and attained through the technical communities within the markets. This study also assumed that the technology center responsible for the dairy proteins had the expertise to develop high quality raw material purchasing specifications for this category. Additionally, it was assumed that this technology center had connections with procurement to assist with supplier negotiations on the new requirements. It was crucial that the purchasers and the raw material

experts collaborated on the purchasing specification updates to ensure that the quality requirements were attainable by the suppliers.

This study focused on the commodity dairy proteins used in the United States Health Division products. The researcher assumed that any U.S. legal requirements were respected in the consolidation efforts in order to remain compliant with local law. This included that cow's milk was the origin of the dairy derivative. Furthermore, key nutrients in the raw materials continued to be reflected in the purchasing specifications to ensure formulation and finished product compliance. It was the assumption that all raw material data used in the consolidation efforts was analyzed using validated methods developed by the Association of Official Analytical Chemists International (AOAC), Food Chemicals Codex (FCC), or by World Foods approved methodology.

It was assumed that SAP would continue to be utilized for the raw material purchasing specifications as this system allowed the greatest visibility for all global locations. Finally, the success of this project was dependent on the fact that World Foods remained in business.

Definition of Terms

Bill of Materials (BOM). "The numbers of parts (components) of all types required in each unit of a product type" (Hua & He, 2010, 745).

Economies of Scale. "Economies of scale result when fewer resources are employed per unit of output as firm (or agency) size grows" (Pellerin, Walter, & Wescott, 2009, 121).

Enterprise Resource Planning System (ERP). "Integrated sets of software modules linked to a common database handling basic corporate functions such as finance, human resources, materials management, sales and distribution" (Robey, Ross, & Boudreau, 2002, 18).

Food Products. Ingredients used for food manufacturing (Hemphill, 2009).

Market. "A region in which goods and services are bought, sold, or used" (Random House Dictionary, 2011).

Product Life Cycle. The evolution of products, divided by four stages, introduction, growth, maturity, and decline (Wong & Ellis, 2007).

Process Standards. "Techniques that must be used to process or package food, with the belief that certain production techniques make food more likely to be safe" (Mitchell, 2003, 15).

Product Standards. "Characteristics that a product must attain before it is considered safe to sell" (Mitchell, 2003, 15).

Self-Regulation. Self regulation exists where a firm, an industry, or the business community establishes its own standards of behavior where no such statutory and/or regulatory requirements exist; or when such established private standards of behavior may actively assist in complying with or exceeding pre-existing statutory and/or regulatory requirements (Hemphill, 1992).

Specification. "A document that states the requirements to which a given product or service must conform" (Summers, 2006, 794).

Limitations of the Study

In this study, the consolidation and quality improvement efforts were limited to the commodity dairy raw material purchasing specifications used within the Health Division in the United States. In some cases, other dairy market specifications were consolidated simultaneously to the same global specifications as the U.S. specifications. The methodology was similar, but this study did not include dairy proteins not used in the United States. This study did not address the methodology for a new dairy protein specification request, even if it involved a consolidation effort. Only current used specifications, identified at the beginning of this project, were

considered in this study. Additionally, only commodity dairy raw materials were consolidated, not specialized dairy raw materials. It was known that specialized products were unique and there was little likelihood of finding an existing specification to consolidate it with.

One U.S. factory was not operating SAP at the time of this study and none of the U.S. co-manufacturing factories operated SAP. Therefore, SAP was not used for the raw material purchasing specifications and subsequently, the dairy proteins used at this factory and the co-manufacturing factories were not considered in this study. This study focused on World Foods factories that utilized SAP and did not include any co-manufacturing facilities.

Methodology

To achieve the purpose of this study, to develop a methodology to consolidate the raw material purchasing specifications while improving the quality, involved following a set of steps. The first step gathered data to determine what dairy purchasing specifications were used at which factories. This was the baseline data and was extracted from SAP. The second step reviewed the existing raw material purchasing specifications for dairy proteins to conclude whether a similar specification existed. This was done by comparing key specification parameters between the existing consolidated specifications and the specifications used in the U.S. Health Division.

The third step extracted existing mineral data from SAP on each specific dairy protein to decide if the data supported consolidation to a new specification. Next, the required specification updates were determined, which included establishing the contaminant levels based upon usage rates and finished product limits. At this stage, markets that used the consolidated specification were contacted to ensure any changes to the specifications were acceptable. Then the supplier was sent the draft raw material purchasing specification for review. Once the supplier agreement

was reached, the specification was routed for approval to all users of the specification. Finally, the factory release systems were updated based upon the new specification parameters.

Chapter II of this paper presents a literature review which focused on sourcing, globalization of food supply and security, centralized control, requirements of a purchasing specification, advantages of consolidation, SAP, and milk and dairy proteins. Chapter III reviews the methodology used in this study, including the data gathering steps. In Chapter IV, the results of the study are discussed, and in Chapter V, the limitations of the study, the conclusions, and the recommendations for follow-up studies are presented.

Chapter II: Literature Review

In today's world, no business is immune to the effects of globalization. Companies have been growing larger, spreading operating units throughout the world. As a company grows, the management of the business can become a challenging task. Many companies seek to bring similarity across operating units, and to have a competitive advantage over other businesses. Some have used globalization and size to their advantage by focusing on sourcing, centralized control, and consolidation. Often an ERP system, such as SAP, is used to streamline processes. This literature review examines these four areas, while also discussing the globalization of food supply, requirements of a purchasing specification, and milk and dairy proteins.

Sourcing

For companies that operated on a global scale and had become consolidated due to buyouts or mergers, a standardized approach to business functions such as sourcing, production, and marketing was both feasible and desirable (Samiee & Roth, 1992). This was especially true for competitive industries that frequently entered new products into the market place. Markets leaders, which introduce products early in a product life cycle, have benefited vastly from standardizing globally as there was more time to capitalize on the results.

Material sourcing has played large role in the quality and cost of the final product, as the quality and cost of raw materials correlate directly with the quality and cost of the final products. Thus, standardizing various aspects of sourcing, such as raw materials, historically has brought higher volumes and lower prices (Lewin, 2004). Standardization was achieved by taking existing components and consolidating the requirements or replacing the component with a consolidated piece (Evans, 2010). Overall, this increased the quality of the materials and lowered procurement and maintenance costs, a goal all companies strive for (Lewin, 2004).

Standardization has also brought further integration to companies, allowing easier changes in raw materials or through securing alternate suppliers, as each component was not specialized (Kilcarr, 2011). By consolidating and standardizing requirements, companies have seen more control, lower costs, and more integration, than running each business separately (Samiee & Roth, 1992).

Globalization and its Affect on Food Security

Globalization has greatly impacted the structure of the world's food supply and one concern with globalization is of food safety (Hemphill, 2009). Food safety regulations, defined as product or process standards, had been developed to ensure that food is safe for consumption (Mitchell, 2003). Developed countries generally have had high food safety standards whereas developing countries typically have not, creating an imbalance in food safety standards.

In 1995, the World Trade Organization (WTO) was established which focused on accelerating global efforts to address free trade, as well as food safety measures (Public Citizen, 2007). The WTO developed a policy titled, The Agreement of the Application of Sanitary and Phytosanitary Measures, or the SPS Agreement. This policy facilitated global trade by eliminating national differences in food standards and eased the importation of food. It also placed responsibility on the export countries regulatory bodies to ensure the food safety requirements were met for those products produced in the respected country. The goal was for the developing countries to meet the most stringent food safety requirements and standards, the ones typically of developed countries (Hemphill, 2009). However, this was routinely not possible due to financial and technological resources. Additionally, the foreign regulatory authorities were not able to effectively and efficiently manage the regulatory requirements due to the volume and complexity of the standards (Public Citizen, 2007).

With the SPS Agreement, if a country banned an import due to a higher than average inspection rate or for a food safety concern, this act had the potential for a trade barrier lawsuit (Public Citizen, 2007). Thus, food safety risks had to be balanced in accordance with the SPS Agreement, which potentially favored free trade over food safety. Additionally, significant food safety risks have historically existed in developing countries, including company paid inspectors, deficient microbiological testing, and raw material and finished product contamination. The challenge that surround globalization of food, focused on monitoring and enforcing the standards of each given country or region.

In the United States, the FDA, which enforced the Food, Drug, and Cosmetic Act, was responsible for ensuring both domestic and imported goods were safe for human consumption (Federal Food Safety Regulation, 2008). This included regulating areas such as produce, seafood, and processed foods, amongst other food categories. The Food Safety Inspection Service, which was part of the United States Department of Agriculture (USDA), regulated eggs, poultry, and most forms of red meat, from both domestic and international sources.

The volume of the U.S. food supply which is imported, has increased in recent years and can be attributed to various factors including changes in diet preference, changes in domestic food supply, lower cost of imported goods, and seasonal variability (Pritchard, 2007). In 2006, $7.6 billion in food ingredients were imported into the U.S., an increase of 73% since 2001. Additionally, $63 billion in other food and drink were imported in 2006, a 65% increase since 2001. This accounted for nearly 15% of the overall U.S. food supply imported from foreign sources (Frumkin, 2008).

In reference to the U.S. imported food supply, much of it is from countries with low food safety standards (Pritchard, 2007). As the SPS Agreement placed the responsibility on the export

markets regulatory bodies to comply with food safety standards, little emphasis had been placed upon ingredient checks for imported goods (Public Citizen, 2007). The FDA has only checked approximately 1% of incoming ingredient shipments, so the majority entered the U.S. with no food safety check (Pritchard, 2007). Ingredients typically required laboratory analysis, which discouraged timely release from customs. Furthermore, ingredients historically were not responsible for the death of consumers as most were further processed. Few regulatory checks on incoming ingredients suggested more ingredients were susceptible for treatment with toxic chemicals, pesticides, or were adulterated (Public Citizen, 2007). Thus, it has been questioned whether the current resources and existing systems were adequate to protect consumers from food safety issues (Federal Food Safety Regulation, 2008).

The FDA has required prior notification of any overseas shipment to the U.S. customs (Pritchard, 2007). However, unless there was a known problem, shipments were rarely checked and overseas companies have not needed to provide documentation or a guarantee that the goods were safe prior to importation. Thus, the inspection of the incoming goods was left to food manufacturers. As the FDA has not been able to adequately enforce the requirement on imported food goods, companies located in the U.S. have been required to self-regulate the imported goods (Hemphill, 2009). According to a 2007 letter from the FDA to U.S. food manufacturers, it was the manufacturers' legal responsibility to ensure all ingredients used in products that are sold on the market are safe for human consumption (Food and Drug Administration). This required self-regulation at the company level as criminal and civil legal liabilities were established to encourage managers to monitor food safety and use state of the art processing equipment (Hemphill, 2009).

Centralized Control

All companies have made decisions whether to set up a centralized approach for various business functions. Centralization of specific business processes has lowered costs, improved efficiency, and allowed for better control over operation activities (Brandel, 2010). Other advantages included decreased labor costs, lower training costs, increased volume discounts, and better disaster recovery strategies. Centralization has also brought consistent structure and standards across companies instead of different operating standards company-wide (Weinstein, 2009). Consistent structure and standards promoted best practices and better utilized expert resources. Additionally, changes in practices were rolled out more efficiently than a decentralized business approach.

Consolidation of the purchasing function was a logical step for a company that had implemented an ERP system (Porter, 1999). This was especially favorable for commodity purchasing to leverage volume, as a centralized purchasing approach allowed for standardization of the purchasing specifications (Shaheen, 2003). A centralized set of standards allowed purchasing from a centralized standpoint, rather than each operations unit or division purchasing goods separately (Clarke, 2005). Lower costs were a result, as volume was leveraged through combined volumes. This brought more purchasing power, optimized systems, improved quality, and reduced duplication of work (Quayle, 2006; Hudson, 2000; Lundgren, 1990). It also allowed for rapid decision-making, brought consistency in the quality of goods, reduced paperwork, allowed specialization in talent and expertise, and allowed for larger contracts (Porter, 1999).

Requirements of a Purchasing Specification

Many industries developed standards, called monographs, and these standards were reflected in the purchasing specification requirements (Wechsler, 2002; Hudson, 2000). These

standards stemmed from various tests and studies including validation data, batch data, stability data, impurities, and research (Kurtulik, et al., 2007). In the drug industry, the International Conference on Harmonization (ICH) along with the FDA, published the Guidance on Q6A Specifications, that guided manufacturers in defining and selecting tests, acceptance criteria, and analytical procedures (Wechsler, 2002). The Code of Federal Regulations (CFR) outlined federal regulation requirements for manufacturers of various industries in the United States (GPO Access, 2009). The FCC outlined requirements specifically related to the food industry worldwide (U.S. Pharmacopeia, 2009). These standards ensured that specifications were neither too broad, which brought lot-to-lot variation in the material, nor too narrow, which increased the amount of non-conforming material and decreased the availability of supply (Wechsler, 2002). These specifications served as a contractual agreement between suppliers and customers, and assisted in setting material quality standards (U.S. Pharmacopeia, 2009).

Specifications also ensured all safety requirements were being met and addressed important parameters related to raw material quality. Many limits reflected finished product applications and the nature of the material itself (Hudson, 2000). Additionally, the requirements, the content, and the quality of the purchasing specification formed a record of data collection that was important for historical reference (Lundgren, 1990).

Advantages of Consolidation

Consolidation of business functions brought many advantages to companies. Economies of scale were realized, which allowed companies to capitalize on fewer resources for a specific task (Kaditi, 2011; Pellerin, et al., 2009). There was typically a reduction in duplicated and overlapped responsibilities, which decreased overall costs and increased effectiveness and efficiency (Pellerin, et., 2009). Responsibilities were centralized, which placed the accountability

for the tasks in one area and reduced pushing off responsibility to other areas. Consolidation also created one contact group for other users.

For complex circumstances or tasks, consolidation brought better management of departments and responsibilities, which subsequently allowed better understanding of specific tasks (Pellerin, et al., 2009). This fueled the development of experts in each area instead of multiple experts in many areas and consolidated decision-making authority into one area. It also increased visibility, transparency, and sharing of information regarding overall project scope. Responsibility was given to the accountable team members and the visibility sparked ideas for other consolidation improvement opportunities. The team members had a stronger association with the implications of the actions chosen and thus decisions, which could negatively implicate a different part of the business, were less likely to occur. Instead, the scope of the situation was considered up-front due to increased visibility and group responsibility.

SAP

SAP, the world leader in ERP systems, provided business software that improved customer relationships and enhanced collaboration (Industry Week, 2009). This created efficiencies across supply chains and other business operations by standardizing practices to ensure stability and quality. Due to globalization, many businesses were faced with an increased number of suppliers, SKU's, items, and experienced high quality costs. Thus, SAP assisted with the complexity of managing these business components and further brought competitive advantages to companies.

In a 2009 study conducted by Goeke and Faley, companies that implemented SAP showed an improvement in inventory management against themselves prior to SAP implementation. That same success translated into improved inventory management against

industry competition. Furthermore, many internal systems were integrated into a single interface, which allowed greater visibility and capability to access all components from one location (Brodkin, 2007). This brought consolidation potential by re-aligning resources and tasks, which improved productivity (Industry Week, 2009). Optimization of material purchasing is a main way companies utilized SAP, which brought better supplier collaboration due to increased visibility. This was a crucial advantage for businesses with high raw material costs. Cost reductions through consolidation were realized by locking in long-term rates with suppliers, or by the qualification of multiple suppliers for the same materials. Thus, the utilization of SAP, consolidated practices, optimized business practices, and reduced costs.

Milk and Dairy Proteins

Milk, and the dairy products derived from milk, were key to many food products as they contained many essential vitamins, minerals, and amino acids (Jost, 2007). Dairy proteins were also a risk of contamination and as a result became heavily regulated by many global authorities. In the U.S., the USDA, the FDA, and the FCC, have all developed specifications to control the quality and risks associated with dairy proteins (USDA, 2006). Globally, the Codex Alimentarius regulated milk and dairy products, and further published the "Code of Principles Concerning Milk and Milk Products" (Jost, 2007). This was adopted by over 70 countries and addressed issues such as food hygiene. It also designated specific chapters that addressed each individual dairy protein and the minimum requirements that must be met.

Health benefits of dairy proteins. Dairy proteins were naturally rich in nutrients and essential amino acids that were important to human growth and development, as well as general human health (Jost, 2007). Dairy products contained many macro minerals including calcium, potassium, magnesium, and phosphorus (Gerdes, 2009). However, dairy proteins also contained

many trace elements such as manganese, iron, copper, zinc, and selenium, as well as important vitamins such as riboflavin, vitamin B2, and cobalamin (vitamin B12). According to the article, *Dairy foods and beverages made with dairy proteins,* from Dairy Foods (2004):

> "Whey protein has the best source of essential amino acids that contain high levels of sulfur, an important compound in the biosynthesis of glutathione, a tripeptide that is associated with antioxidant, anti-carcinogenic and immune-stimulation properties in addition to branch-chained amino acids which stimulate muscle protein synthesis" (pg. 32A).

Milk proteins, particularly casein forms, also assisted with dental protection by neutralizing plaque and bacteria, while also providing large amounts of soluble calcium (Jost, 2007).

Dairy protein microbiology. Many compendia standards for dairy proteins contained microbiological specifications, which usually included total plate count, coliforms, enterobacteriaceae, salmonella, staphylococcus, thermophilies, yeasts, and molds (USDA, 2006). High levels of enterobacteriaceae brought off odor and flavor deterioration as well as off-color and slime to various products, but also indicated there were serious contamination issues or unclean processing equipment (Jost, 2007).

The processing application of a dairy protein either increased or decreased the risk for microbiological growth. Generally, if the dairy processing application included some sort of heat treatment, such as spray drying, the micro risk was reduced for some pathogenic strains (Arku, Mullane, Fox, Fanning & Jordan, 2008). However, spray drying does not kill all microbiological growth, as some strains of E. sakazakii outlive this heat-kill step. Some types of spores can produce heat resistance species which survive pasteurization and thus spore control on the raw material was needed (Jost, 2007). As milk was a good growth medium for many

microorganisms, effective legislation determined what organisms would pose concerns for varying processing applications.

Dairy protein contaminants. Dairy proteins were susceptible to many forms of contamination. Pesticides entered the milk supply due to a cow's ingestion of grass, weeds, or insects that were contaminated from the water sources or ground treatment (Jost, 2007). Disease prevention in cows often involved antibiotic usage, which caused further issues in downstream milk processing. In some countries, it was allowed to inject cows with hormones to raise milk production, and the hormones were passed into the milk. Other earth contaminants such as lead, aluminum, arsenic, mercury, and cadmium, often were ingested due to heavy metal pollution in the environment. Nitrate was also naturally found in milk, where nitrite was typically only developed via processing techniques. Through processing, dairy proteins have higher levels of nitrate and nitrite, which developed into nitrosamines, which are known carcinogenics.

Dairy proteins were also subject to contamination due to human adulteration. Post 9/11, the U.S. government increased the regulation for heat pasteurization of milk due to large U.S. consumption and the existing concern for tampered milk (Wein, 2007). Milk was an easy source to infiltrate a contaminant in that could ultimately affect the health of many people. In 2008, milk producers in China adulterated milk sources by watering down raw milk to increase volume, which decreased nutrient and protein levels (Yardley, 2008). As the milk was watered down, melamine was added to artificially boost protein levels and this milk was subsequently sold for infant formula production (Interfax, 2009). Proteins naturally contained large amounts of nitrogen and the protein content of milk and other protein derivatives was analyzed by testing for nitrogen (Jost, 2007). Adding nitrogen-rich melamine to milk falsified the amount of protein

actually present in the milk or the milk derivative (Furusawa, 2011). Monitoring melamine and other contaminants were now an important means to ensure food safety.

It is anticipated that globalization will continue to play a major role in the world economy and thus companies continue to search for practices that bring a competitive advantage to the business. This has previously been achieved by understanding the effects globalization has on a particular business and by setting standards in key business product areas. In World Foods, the focus was placed on sourcing, centralization, and consolidation in a key product area, the dairy proteins. Additionally, World Foods utilized SAP to streamline business processes. The next chapter will provide a discussion on the details of the methodology used to consolidate the raw material purchasing specifications and to perform the necessary quality updates.

Chapter III: Methodology

The purpose of this study was to develop an approach to consolidate raw material purchasing specifications, while improving the quality of the specifications. This study focused on the dairy raw material purchasing specifications used within the United States for Health Division products; However the methodology developed was used for all raw material categories. World Foods Health Division required that this project be completed by the end of 2010, targeting a two-year project scope. Dedicated teams were developed to focus on this consolidation project, and were also assigned the responsibility to handle any new specification requests in order to maintain consolidation and to oversee future consolidation opportunities. The dedicated teams utilized a centralized ownership approach versus the previous decentralized approach. Through this study, higher quality specifications were developed and the overall number of purchasing specifications was reduced. Thus, at the completion of the project, purchasing had greater purchasing power as well as a consistent set of requirements to procure against.

The chapter identifies the subject of the study and the project focus area, dairy proteins. The instrumentation used to track the project status will also be discussed. Data collection procedures are also described, including overall progress on consolidation, raw material data extraction from SAP, supplier and market data collection, and final project data including the number of dairy specifications consolidated and the percentage of consolidated dairy spend and volume. This chapter will also discuss how data was analysis and the limitations of the study.

Subject Selection and Description

The subject of the study was the dairy raw materials used within the United States for health applications. This included all dairy specification usage at the World Foods manufacturing

locations. At the beginning of the study, each World Foods manufacturing facility purchased from raw material purchasing specifications used solely by the U.S. market. Many important quality parameters were missing and there was little consistency between the dairy purchasing specifications used within the U.S. market. However, this lack of consistency was also reflected in the global specifications for dairy proteins. Any time a new specification was created, it was created locally, and there was no global oversight for consolidation. This resulted in duplicated specifications. Dairy ingredient experts were also not consulted for quality and safety requirements that should be part of the specifications.

Instrumentation

The instrumentation used for the consolidation effort was SAP and Excel. All of the purchasing specifications were located in SAP and data extractions were made to gather information on market usage and consolidation completion. Reports were extracted from SAP to determine purchasing activity and it was further deduced whether the purchasing was being conducted on local market specifications or consolidated specifications. If the purchasing activity was conducted on local market specifications, these specifications were identified to be consolidated. If the purchasing was conducted on consolidated specifications, these specifications were considered complete. Additionally, this extraction showed gaps in the project status, as specifications were marked as consolidated, but no purchasing activity had yet taken place on the consolidated specifications. This indicated either a system issue occurred or that all consolidation activities had not yet been completed. Quarterly extractions occurred and were reviewed during the group progress meetings.

Team rooms were developed for each technology center to track daily updates on the project status. The daily updates were necessary due to the large project scope. These team

rooms were created especially for this project and the database used for tracking was Excel. Each specification which required consolidation, was listed in Excel, with separate columns for proposed consolidated spec, final consolidated spec, SAP spec status, completion date, and comments. Each technology center tracked the status on a monthly basis to submit to the entire project team.

Data Collection Procedures

The data required for this consolidation and quality update study occurred in various steps throughout the project. These different data collection steps defined the starting point of the project, assisted in the consolidation efforts, and determined whether the specification was consolidated. These data collection steps are listed below.

1. List of raw material numbers (parts)
2. List of U.S. Health Division specifications (corresponding to the above parts)
3. List of technology center's current dairy specifications (parts)
4. Raw material nutritional data for each dairy protein (numeric values)
5. Supplier nutritional data (numeric values)
6. Compendia data from Codex and FCC (min and max requirements)
7. Contaminant data from World Foods (numeric values)
8. Supplier contaminant data (numeric values)
9. Newly obtained contaminant data (numeric values)
10. Usage rate data from formulations (numeric values)
11. Final list of U.S. Health Division specifications (parts to determine consolidation)

Data from points, 1, 2, 3, and 11 represented data outlining the overall project status and was extracted and reviewed on a quarterly basis. This data also aided in discussions surrounding

consolidation difficulties as well as determining project status. Additionally, each technology center was responsible for the extraction and validation of the data to fix any discrepancies related to the project status.

Data from the remaining points was specific to each dairy protein undergoing consolidation. Typically, many consolidation efforts occurred simultaneously, thus the researcher extracted this data as needed. The researcher was responsible for validating the raw material data used in the consolidation methodology. Once the data specific to each dairy protein was complied, it was used to determine if a consolidation was possible. The data was also used to set the contaminant limits and other quality parameter updates. This information was included in each raw material consolidation folder.

Data analysis. The current list of specifications, before any consolidation occurred, was the first data collected. BOM extractions through SAP were conducted for each World Foods Health Division manufacturing site. The BOM extraction pulled a list of the raw material numbers used based upon the finished product recipes. The raw material numbers for each manufacturing site were compiled and correlated to the corresponding raw material purchasing specifications. This data was used to analyze the current state of the specifications to determine how many specifications needed to be consolidated and/or needed a quality update. This information was populated into Excel and uploaded into the online team room for status updates. For the purpose of this study, the list of specifications in the team room was sorted by the dairy proteins used at the U.S. Health Division factories. The table below outlines this information.

Table 1

Commodity Dairy Proteins Used Within the U.S. Health Division Factories

Specification Number	Specification Name	Factory Using
1000012345	Protein Calcium Caseinate Powder	A
1000023456	Protein Whey Liquid	B
1000034567	Protein Whey Powder	B
1000045678	Protein Caseinate Calcium Powder	B
1000056789	Protein Caseinate Sodium Powder	B, C
1000067890	Protein Caseinate Powder	B
1000078901	Protein Whey Concentrate Powder	B
1000089012	Protein Whey Concentrate Powder	B
1000090123	Protein Caseinate Hydrolysate Powder	B

The first column in the table represents the dairy specification number used by the U.S. Health factories before consolidation. The second column represents the corresponding specification name and the third column represents the factory using the raw material purchasing specification. Specification #1000056789 was used by more than one manufacturing facility.

The technology center responsible for the dairy proteins had a list of raw material purchasing specifications that were already owned and consolidated. This list was kept in an Access database and therefore, was not included in this report. This list was consulted for each specification undergoing consolidation to determine if a similar consolidated specification existed and could be a possible spec to consolidate with. This master consolidation list was always being updated with each consolidation or specification quality update that occurred, so

the data was continually changing. The consolidated specifications had a specific naming scheme that included the type of dairy protein and the protein content. The Access database also contained the supplier product name, as it was discovered there were often duplicate specifications for the exact same raw materials supplied globally.

If a similar specification existed from the technology center database, the U.S. spec and the global spec were manually inspected, comparing protein content, microbiological plans, and specific mineral ranges. If the specifications were used for the same processing applications, and thus had the same microbiological plans, and also had the same type and level of protein, further investigation was conducted on the mineral profiles to determine if a consolidation could occur. This involved gathering data from a few areas on the U.S. raw material. First, supplier data from each dairy protein was gathered. This included supplier nutritional data sheets and product specifications. This information was often already available in World Foods files, but if it was outdated, new information was requested.

Mineral data was extracted from SAP for each raw material to determine if the data supported consolidation. This mineral data was actual raw data from the World Foods plants. The minerals and protein content were tested on a per lot basis for each incoming lot of dairy protein. The data used in this project spanned two years worth of data. The minerals tested included calcium, sodium, potassium, phosphorus, chloride, and magnesium and the data displayed the highest and the lowest result for each mineral. This mineral data was compared against the proposed specification mineral range to determine whether historical conformance showed compliance. If the data was comparable to the proposed specification and/or slight changes were needed, a request was made to the other markets using the specification on whether the proposed changes were acceptable. Below is an example of this process.

Specification #1000078901 Protein Whey Concentrate Powder was proposed to consolidate with specification #1000223344. Both specifications were for whey protein concentrate powders. Specification #1000078901 had a minimum protein content of 85% dry basis and maximum sodium content of 275 mg/100g whereas specification #1000223344 had a minimum protein content of 87% dry basis and a maximum sodium content of 150 mg/100g. The supplier nutritional data and product specification showed initial compliance to specification #1000223344, thus a further assessment was conducted.

Data was extracted from SAP for the protein and sodium content on the U.S. material to further support the consolidation. The internal protein and sodium data is located in Tables 5 and 6 in the Appendix. The data illustrated conformance to the higher protein minimum of 87% dry basis listed on specification #1000223344. However, the data for sodium was much higher than the maximum of 150 mg/100g. Thus, the markets using specification #1000223344 were contacted to determine if the sodium limit could be increased on the specification. It was determined that the sodium maximum could be increased to 230 mg/100g. This was acceptable for the U.S. recipe and supply base as 95% of the results were below 230 mg/100g. Thus, the consolidation proceeded as any sodium results on the incoming whey above 230 mg/100g would be exceptionally released. If it would have not been possible to consolidate these two specifications, the U.S. specification would have been converted to a global specification and further updates would have been made to the specification as outlined below. It was assumed that the best matching specification was the specification proposed for the consolidation and thus the process did not start over with finding a new specification to consolidate with.

Throughout this study, it was found that different mineral ranges were included on the market specifications versus the consolidated specifications, even though the material was the

same from the supplier. As the supplier was only supplying one material, the ranges on the specification should represent what was being delivered. This was a learning experience from the consolidation and it was determined that numerous materials were being purchased from different specifications, even though the material itself was the same.

If the proposed changes were acceptable to all markets, a revision was created to the consolidated specification to update the mineral and protein limits. Additionally, any compendia requirements from Codex or FCC were also reviewed and any necessary updates were made to the purchasing specifications. The specifications also reflected any legal requirements and thus the limits outlined in the various compendia were reflected in the purchasing specification for the raw material.

Next, the contaminants were reviewed to determine what updates were needed. Heavy metal data was extracted from SAP, although this data was quite limited. This consisted of the following: mercury, lead, arsenic, cadmium, and aluminum, as well as nitrate and nitrite. Each supplier was contacted for any existing contaminant data that was routinely being generated. If the supplier or the manufacturing site had very little data, additional data was generated by either the supplier or the manufacturing facility, and in some cases, both. If new data was generated, it was requested to analyze three different, non-congruently produced lots, manufactured within the last two years. Nearly all raw material purchasing specifications that were used in the Health Division products were required to have contaminant limits. Thus, current data assisted in supporting the contaminant limits or in the development of new contaminant limits, based upon finished product requirements and the usage rate of the raw materials in the recipes.

All purchasing specifications assessed in this project underwent a contaminant review. Many times, specific contaminant requirements were excluded in previous specification versions.

The business practice had changed and now all contaminants defined as medium or high risk were to be included in the raw material purchasing specifications. The global contaminant experts conducted the contaminant assessment, which represented the inherent risk of the material, outside of the manufacturing location or sourcing region. This was important, as the quality of the specifications was not to fluctuate based upon sourcing region. Contaminants added to all dairy purchasing specifications included a limit for aluminum, lead, arsenic, cadmium, mercury, melamine, cyanuric acid, nitrate, and nitrites. No antibiotic usage was allowed for the raw milk used for the protein derivatives.

In all possible circumstances, similar contaminant limits were applied for similar raw materials (i.e. all whey specifications had the same limits). This assisted in the development of one grade specification used globally, based upon worst-case scenario. To determine the contaminant limits, the highest usage rate and the tightest finished product limit were considered. The contaminant limit was calculated by the formula below, where 'x' is the amount contributing to the finished product:

Usage Rate * Considered Contaminant Limit = x contribution to finished product

For example, if the usage rate of a dairy protein was 9.8% and an aluminum limit of 2.5 mg/kg was being considered, this equated to 0.245 mg/kg potential contribution to the finished product. If the finished product limit was 2 mg/kg for Aluminum, this limit was acceptable in the purchasing specification.

Other raw materials used in a recipe that were potential contaminant carriers were considered when setting contaminant limits in a given purchasing specification. Raw materials, such as calcium salts, acacia gum, or guar gum, have high levels of aluminum and were considered in the overall contaminant contribution in the recipe. Otherwise, setting high

contaminant limits for all raw materials resulted in non-compliant finished products. Thus, a higher tolerance was allowed for those raw materials that have naturally higher levels of contaminants, but lower limits were placed upon other raw materials, which were less likely to contribute high levels of contaminants. This step in the process was very important as if the contaminants were not controlled on the incoming raw materials, it was very difficult to meet internal policy or national law for contaminants in the finished products. Additionally, the limits had to be achievable by the suppliers. This step often resulted in negotiations with the suppliers as many times tighter contaminant limits were not easily agreed upon, regardless of whether the limit was achievable. Thus, requesting data from the supplier and/or generating data gave a better picture of the typical levels. Some contaminants, such as melamine and cyanuric acid, were controlled by law so these requirements were non-negotiable and were included in all dairy protein specifications.

Once the draft specification was set, the ingredient expert reviewed it, followed by the markets using the specification, and finally the suppliers, as agreement was required prior to finalizing the specification internally. Once agreement was reached, the material number which was used for procurement activities and recipes, was moved to the new specification. The consolidation was considered complete from the viewpoint of this study, although data generated against the BOM determined consolidation completion from a procurement standpoint, as procurement activity was needed against the consolidated specification. Figure 1, in the Appendix, shows a flow chart of the consolidation and quality update process.

Limitations of the Methodology

One limitation of the study was the accuracy of the data. The data was only as accurate as it was entered into the system. If the purchasing activity data was not accurate, specifications

which needed to be consolidated, would not be included in the study. Additionally, the mineral and protein data needed to be accurate to ensure successful consolidation efforts. The hand-written raw data files for minerals were not accessed in the case of major discrepancies and instead, outliers were thrown out of the data analysis.

The cost implication of increasing the quality of the purchasing specifications by adding or tightening contaminant parameters was not considered in this study or the overall project. This was a business decision which will not be discussed. Additionally, if the suppliers had to monitor or guarantee additional contaminant requirements, these costs were likely passed onto World Foods during contract updating. This was also not considered in this study.

Summary

The purpose of this study was to develop an approach to consolidate raw material purchasing specifications, while improving the quality of the specifications. It focused on the dairy raw material purchasing specifications used within the United States for Health Division products. Higher quality specifications were developed and the overall number of purchasing specifications was reduced. The overall project status was tracked through Excel and most of the data collected was from the suppliers or it was extracted from SAP. This included market data collection and final project data, including the number of dairy consolidated specs, and the percentage of consolidated spend and volume.

Chapter IV: Results

The purpose of this study was to develop an approach to consolidate raw material purchasing specifications, while improving the quality of the specifications for the dairy raw materials used by World Foods Health Division. This project was needed as, on a global basis, World Foods purchased many of the exact same or very similar raw materials from the same suppliers, but through different purchasing specifications with dissimilar requirements. This provided an inconsistent set of standards to the suppliers. World Foods Health Division required that this project be completed by the end of 2010, targeting a two-year project scope.

To achieve the purpose of this study, the Health Division centralized the specification development and consolidation activities. World Foods also utilized the existing SAP system to support the consolidation efforts as the purchasing specifications and the existing raw material data were kept in SAP. Additionally, all new purchasing specification requests were required to be made through the responsible technology center to maintain all of the consolidation efforts.

This chapter will review the current state of the U.S. dairy specifications before the consolidation, detailing the number of specifications. Next, the results of the consolidation will be shown, detailing which specifications were consolidated and which specifications could not be consolidated. For the specifications that could not be consolidated, the reasoning will be discussed. Finally, the success of the consolidation will be assessed, detailing the reduction in the number of specifications, as well as the percentage of volume and cost consolidated.

The US Dairy Specifications Before Consolidation

The first step in this project was to extract a list of the dairy raw material purchasing specifications currently used by the U.S. World Foods Health Division. The table below outlines this list of specifications, which either needed to be consolidated and/or needed a quality update.

Table 2

Commodity Dairy Proteins Before Consolidation

Specification Number	Specification Name	Factory Using
1000012345	Protein Calcium Caseinate Powder	A
1000023456	Protein Whey Liquid	B
1000034567	Protein Whey Powder	B
1000045678	Protein Caseinate Calcium Powder	B
1000056789	Protein Caseinate Sodium Powder	B, C
1000067890	Protein Caseinate Powder	B
1000078901	Protein Whey Concentrate Powder	B
1000089012	Protein Whey Concentrate Powder	B
1000090123	Protein Caseinate Hydrolysate Powder	B

In total, nine specifications were addressed. These protein specifications, considered commodity dairy proteins, were focused on as specialized dairy proteins were unlikely to be consolidated as they were specialized materials.

The US Dairy Specifications After Consolidation

The consolidation activity, which was discussed in the methodology chapter, was followed for all of the specifications outlined below. In some circumstances, numerous discussions with the different factories or suppliers were required in order to achieve consolidation. For other specifications, it was not possible to consolidate, as there was not a similar specification available, even though these were commodity proteins. In some cases, there was a specific mineral range that a market or factory required in the specification, thus

eliminating the possibility for consolidation. These specific incidents will be discussed, as well as, what future steps could be made to assist in future consolidations.

Table 3

Commodity Dairy Proteins Specifications After Consolidation

Previous Specification Number	Consolidated Specification Number	Specification Name	Number of Markets Using
1000012345	1000112233	Protein Calcium Caseinate Low Sodium	3
1000023456	1000023456	Protein Whey Liquid	1
1000034567	1000034567	Protein Whey Powder	1
1000045678	1000045678	Protein Caseinate Calcium Powder	3
1000056789	1000056789	Protein Caseinate Sodium Powder	4
1000067890	1000067890	Protein Caseinate Calcium Low Sodium	1
1000078901	1000223344	Protein Whey Concentrate Powder	3
1000089012	1000334455	Protein Whey Concentrate Powder	4
1000090123	1000445566	Protein Caseinate Hydrolysate Powder	3

In total, four of the nine specifications were able to be consolidated with existing specifications. Two of the remaining specifications, specification #1000045678 and specification #1000056789 became globally consolidated specifications and other markets consolidated to these specifications. Therefore, these specifications were considered consolidated as the overall number of specifications was still reduced. The three remaining specifications only underwent a quality update and became new global specifications although no other factories were yet using these specifications.

Specification #1000023456 was unable to be consolidated with any other global specification due to the physical form of the ingredient. The ingredient, whey, purchased in a liquid form, was rare as it required a unique logistical relationship, with the supplier located in close proximity to the manufacturing facility. This was because liquid whey has a very short shelf life and must be continually replenished. Thus, this was a special circumstance as most other World Foods plants did not purchase liquid whey due to the logistical constraints. Specification #1000034567 was related to the previous specification, as this was the powdered form of the liquid whey spec. It was the contingency supply option, rarely used by the current factory, and thus less likely that another factory would utilize it. As the specifications were a special case, recommendations to further promote a consolidation will not be given.

Specification #1000067890 was unable to be consolidated with an existing specification due to the extremely restrictive sodium range required, which is related to the contribution in the recipes. The sodium delivered by this raw material was the key sodium contributor in the recipes, and without this level of sodium, the finished products were non-compliant. For future consolidation efforts, it was recommended that the products that used this dairy protein be reformulated for a broader acceptance of sodium, which allowed the consolidation of this purchasing specification.

Overall Consolidation Results

The overall result of the dairy protein consolidation for the U.S. specifications was positive. There was a reduction of six dairy purchasing specifications due to consolidation, which equated to a 67% reduction in the number of dairy purchasing specifications before consolidation. This consolidation brought volume consolidation, which allowed more volume to be purchased from one specification, and increased the total spend per specification. This

allowed procurement to better utilize volume and spend discounts with the suppliers in this key raw material category. The table below outlines the consolidated specifications and the total volume and spend percentages associated with each U.S. dairy specification consolidation. These results are from 2010 volume and spend.

Table 4

Consolidated Dairy Protein Specifications Total Volume and Spend

Consolidated Specification Number	Volume from U.S. (%)	Increase from Consolidation (%)	Spend from U.S. (%)	Increase from Consolidation (%)
1000112233	99%	-	99%	-
1000045678	56%	128%	53%	113%
1000056780	12%	14%	11%	12%
1000223344	64%	177%	61%	155%
1000334455	70%	237%	68%	215%
1000445566	95%	2117%	93%	1327%

For most of the newly consolidated specifications, the U.S. was now contributing heavily towards the overall volume and spend per specification. For specifications #1000112233 and #1000445566, there was very little spend from other markets. Thus, the consolidation did not have a large impact. However, these two consolidations still reduced the overall purchasing specifications by two, so there was less specification management involved.

For specifications #1000045678, #1000334455 and #1000223344, there was some considerable spend already existing on the consolidated specifications. For specification #1000045678, the U.S. was now contributing 56% of the total volume and 53% of the total spend. These contributions were calculated by taking the total U.S. 2010 volume/spend divided

by the total 2010 volume/spend purchased from the specification. This equated to a 128% increase in the overall volume procured, and a 113% increase in the total dollar spend from this specification. These percentage increases were calculated by summing the increase in volume/spend and dividing by the total volume/spend before the consolidation occurred.

For specification #1000334455, the U.S. was now contributing 70% of the total volume and 68% of the total spend. This was a 237% increase in the total volume and 215% increase in the total spend. For specification #1000223344, the U.S. was now contributing 64% of the total volume and 61% of the total spend. This was a 177% increase in the total volume and 155% increase in total spend. These three consolidations were extremely beneficial as large spending markets were consolidated and this brought even more volume and spend to the consolidated specifications, which provided more purchasing leveraging power. This also reduced the overall purchasing specifications by three and allowed greater visibility to global market usage.

For specification #1000056780, the U.S. consolidation added an additional 12% to the total volume and 11% to the total spend. Other markets procured large volumes from this specification and adding the U.S. volume to this specification brought procurement benefit by the additional purchasing advantage. It was likely the U.S. saw a cost savings with consolidation to a specification with a larger procured volume.

Chapter V: Discussion

This study focused on developing an approach to consolidate raw material purchasing specifications, while improving the quality of the specifications for the dairy raw materials used by World Foods Health Division. This project was important to World Foods as many of the exact same or similar raw materials were purchased through different purchasing specifications with dissimilar sets of requirements, providing inconsistency to the suppliers. This study focused on the dairy raw materials used in the U.S.

Chapter I covered the effects of globalization on the world food supply and the importance of developing high quality raw material purchasing specifications. This was the backbone in World Foods decision when the project was developed, to improve the quality of the raw material purchasing specifications and to consolidate requirements globally. Chapter II examined the literature related to sourcing strategies, globalization of the food supply, advantages of centralized control, requirements of a purchasing specification, consolidation advantages, utilizing SAP for consolidation, and the importance of milk and dairy proteins. Chapter III discussed the methodology used to consolidate the dairy raw material purchasing specifications, including how the quality updates were determined and applied to the purchasing specifications. This methodology for consolidation was implemented for all dairy raw material purchasing specifications used in World Foods Health Division. The results of the consolidation and quality update study were presented and discussed in Chapter IV.

This chapter reiterates the limitations of the study and discusses the results in relation to the literature. The conclusion will highlight the major accomplishments of this study. Finally, recommendations based upon the study results will be presented.

Limitations

This study focused on the consolidation and quality improvement efforts to the dairy raw material purchasing specifications used within the Health Division products produced in the United States. Thus, while the methodology was similar, this study did not include dairy proteins not used in the United States, even when other dairy market specifications were consolidated to the same global specifications. Additionally, this study did not address the methodology for a new dairy protein specification request, even when it involved a consolidation effort. Finally, only currently used specifications were considered in this study.

One U.S. factory was not operating SAP at the time of this study and none of the U.S. co-manufacturing facilities operated SAP. Therefore, SAP was not used for the raw material purchasing specifications and subsequently the dairy proteins used by this factory and the co-manufacturers were not considered in this study. This study was only focused on World Foods factories that utilized SAP and did not include any co-manufacturing facilities.

The accuracy of the data was also a limitation in this study, as the data was only as accurate as it was entered into SAP. If the purchasing activity data was not accurate, an exact list of the specifications which needed to be consolidated would have been difficult to extract. Additionally, the mineral and protein data needed to be accurate to ensure successful consolidation efforts. The hand-written raw data files which contained mineral results were not accessed in the case of major discrepancies and instead, outliers were thrown out of the data analysis.

The cost implication of increasing the quality criteria on the purchasing specifications by adding or tightening contaminant parameters was not considered in this study, or the overall project. This was a business decision that will not be discussed in this study. Additionally, if the

suppliers had to monitor or guarantee additional contaminant requirements, these costs were likely to be passed onto World Foods during contract updating. As this consolidation effort focused on the quality improvements, cost to improve the quality was not considered.

Development of the Methodology

The development of the methodology was important to ensure a consistent approach was used throughout each consolidation. The methodology created visibility in the process steps and brought awareness of parties affected by the consolidation, including markets and suppliers. Utilizing a centralized approach brought control to the project team and increased visibility of the specifications used globally. As time progressed, decisions related to specification consolidation became easier as knowledge expanded in relation to what specifications were used where. A deeper level of responsibility was also gained, as all of the specifications for this raw material category were under the control of the same technology center. This increased confidence in all team members and emphasized the importance of the work.

SAP assisted in the consolidation efforts, as reports were pulled from the system to determine the ever-changing specification usages. Initial reports were extracted to determine specifications to consolidate, but SAP was a live system, and this information continuously changed. SAP brought vast visibility to all users and data extraction was very efficient.

Prior to this study, the food industry underwent a scandal in China related to the quality of raw milk used in infant formula production. This issue had damaging effects and reinforced the importance of high quality raw materials. It increased awareness in the severity of food safety and reconfirmed why this project was needed for World Foods. It was extremely important to be proactive in regards to food safety and to continually strive to raise the minimum standard of food quality.

Conclusions

The results of this study were a success from the consolidation and quality update viewpoint. The number of dairy specifications used within the U.S. health market was reduced by six commodity specifications and therefore, spend and volume were consolidated, which allowed procurement to leverage buying power. There were more opportunities for alternate sources, as more suppliers supplied to a single specification. In cases where suppliers provided the same raw material under different specifications, the consolidation streamlined purchasing requirements for the supplier. There were no longer different specifications for the same raw materials. This also reduced the amount of maintenance on the purchasing specifications.

All specifications were updated for the latest quality requirements. This brought confidence to World Foods in ensuring the raw materials purchased were of the highest possible quality. This assured that not only finished product requirements were met but also that World Foods produced safe products for the consumers. This allowed World Foods to continue to be a leader in the food industry, inspiring consumer confidence.

Overall, the conclusions of this paper match the discussions in the literature review. Food globalization has brought concern to raw material quality. The development of high standards in the purchasing specifications ensures that high quality raw materials were purchased and consistency in the purchasing specifications was achieved. Centralized control and consolidation of requirements brought large advantages to World Foods, as duplication was reduced and responsibilities were centralized. Future specification updates were more efficient, as the specifications were under the responsibility of one team. In the case of another food security scandal, specification usage can be extracted from SAP and the purchasing specifications can be updated efficiently.

Recommendations

Two of the following recommendations are based upon changes made within World Foods Health Division that impacted the consolidation efforts, while the remaining other recommendations would allow for future consolidations for World Foods.

Halfway through the study, World Foods Health Division changed the approach for setting the contaminant limits, to only include limits on the purchasing specifications for medium and high risk contaminants. Thus, specifications that were already updated to include contaminants for low risk items needed to be further revised. In the future, the approach for determining whether to include particular contaminants or other specification parameters should be established at the beginning of the project.

The project timeline was established based upon the number of specifications that needed to be addressed. The number of resources assigned was in accordance to this timeline. After the timeline was set, World Foods Health Division underwent two major acquisitions that increased the number of purchasing specifications in the division. However, the overall project timeline was not adjusted nor were additional resources provided. While all raw materials used in the U.S. Health Division were completed, globally, the project was not completed within the two years.

The microbiological requirements set on the purchasing specifications directly reflected the finished product microbiological limits. There were different finished product microbiological limits for product categories and in some cases these were very similar to each other, but different enough to warrant separate raw material purchasing specifications. An area for improvement was to streamline the finished product microbiological requirements to further consolidate the raw material purchasing specifications. Any raw materials that undergo ultra-high heat treatment or sterilization represented the biggest opportunity for improvement.

Future Application

This consolidation project and the methodology used could apply to raw material groups in other divisions within World Foods. This project solely was focused on the Health Division, and this study only on the dairy proteins. While dairy proteins were extremely important to World Foods, it comprised only a portion of the overall business. Thus, World Foods could capitalize on the methodology and consolidation techniques used in this study and apply it to other company divisions.

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Appendix A: *Additional Tables and Figures*

Table 5

Sodium Results (mg/100g) for Specification #1000078901 Consolidation

Lot Number	Result	Lot Number	Result	Lot Number	Result	Lot Number	Result
1	147	29	193	57	202	85	201
2	204	30	186	58	174	86	220
3	209	31	186	59	202	87	246
4	182	32	205	60	174	88	248
5	180	33	190	61	209	89	222
6	181	34	189	62	282	90	250
7	181	35	188	63	215	91	232
8	159	36	182	64	245	92	207
9	180	37	203	65	233	93	215
10	152	38	153	66	180	94	193
11	193	39	197	67	217	95	242
12	208	40	177	68	210	96	177
13	179	41	165	69	227	97	180
14	146	42	180	70	163	98	213
15	213	43	162	71	204	99	242
16	200	44	196	72	191	100	210
17	178	45	186	73	233	101	199
18	173	46	177	74	207	102	164
19	176	47	206	75	151	103	191
20	199	48	168	76	227	104	197
21	179	49	165	77	146	105	217
22	188	50	168	78	224	106	164
23	211	51	208	79	223	107	156
24	170	52	173	80	234	108	156
25	179	53	195	81	142	109	108
26	191	54	215	82	228	110	197
27	175	55	194	83	184	111	222
28	210	56	188	84	170		

Table 6

Protein Results in g/100g for Specification #1000078901 Consolidation

Lot Number	Result	Lot Number	Result	Lot Number	Result	Lot Number	Result	Lot Number	Result
1	89.8	35	88	69	88.5	103	88.9	137	88.1
2	88.5	36	88.9	70	88.6	104	89	138	87.6
3	89.1	37	89.1	71	88.9	105	89.1	139	88.1
4	89	38	89.2	72	88.8	106	89.1	140	87.8
5	89.6	39	87.9	73	88.7	107	89.2	141	87.1
6	89	40	88.1	74	88.8	108	89.5	142	88.2
7	89	41	87.3	75	89	109	89.5	143	88.2
8	89	42	88.4	76	89	110	89.1	144	87.8
9	88.7	43	88.5	77	89.4	111	88.2	145	87.2
10	88.7	44	88.7	78	89.7	112	89.5	146	88.1
11	88.8	45	88.5	79	89.2	113	88.8	147	88.1
12	88.4	46	88.9	80	89.5	114	89.2	148	87.3
13	89.2	47	89.3	81	89	115	88.3	149	87
14	89	48	88.7	82	88.9	116	87.7	150	87.8
15	89.1	49	89	83	89.3	117	88.8	151	88.3
16	89.5	50	88.6	84	89.5	118	87.9	152	87.8
17	89.2	51	88.7	85	89.6	119	88.7	153	88
18	89.3	52	89	86	89	120	88.2	154	88
19	89.2	53	88.8	87	89.7	121	88.2	155	89
20	89.6	54	88.2	88	89.6	122	87.5	156	89
21	89.1	55	88.2	89	89.2	123	88.8	157	89
22	89.5	56	88.5	90	87.7	124	88.1	158	88
23	88.9	57	88.5	91	88.3	125	87.8	159	89
24	89.1	58	88.4	92	87.7	126	88	160	90
25	88.8	59	88.7	93	89.7	127	87.5	161	88
26	88.6	60	88.9	94	89.4	128	86.6	162	89
27	88	61	89.1	95	89.6	129	86.3	163	89
28	89	62	89.1	96	88.9	130	88	164	89
29	89.1	63	88.2	97	89.4	131	87.5	165	89
30	87.7	64	88.7	98	89.3	132	88.4	166	88
31	88.3	65	89.2	99	89.2	133	86.8	167	89
32	88.3	66	88.9	100	89.6	134	88.2	168	89
33	87.2	67	89	101	89.4	135	87.6	169	89
34	87.9	68	89	102	89.1	136	88	170	89

Figure 1

Consolidation Methodology Flow Chart