DESIGNING A SUPPLY CHAIN FOR WINE IMPORTS, ITALY TO CALIFORNIA

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Executive Summary

In this report a framework for a hypothetical business will be covered. Bucher & Magnuson Wine Import Inc. has provided a business plan as well as a detailed supply chain design for operations. In addition, a model for scaling and a redesign of a possible storage facility will be found. This comprehensive document outlines end to end the supply chain model of the hypothetical business and moreover a framework for starting a wine import business in San Luis Obispo.

The conclusions of the results from this model are the following:

- Unconcerned with time, the cheapest route for 1 TEU, standard twenty foot shipping container, of 56 pallets of wine is to go from the port of Livorno, Italy through Long Beach and trucked up to Paso Robles, California.
- The optimal allocation of wine in our TEU based on a customer demand survey of the target market, San Luis Obispo, are 321 cases of Tegolaia Toscana, 236 cases of Calice Del Conte Toscana, 111 cases of Chianti Rufina, and 228 cases of Gavignano.
- Based on the business plan including the sales and operations report, this is a profitable venture resulting in a net profit of roughly $71,000 before taxes.
- By classifying inventory based on pick frequency and implementing a reorganization of pallets, the storage facility has a new layout for optimal picking processes.
- After simulating the business being scaled to meet future higher demand volumes, New York becomes the optimal port for adding to system throughput.

Recommendations and environmental impacts for this industry are discussed within the conclusion. Utilizing LCL shipping methods as well as ERP concepts to optimize the 3 tier system that is the wine business today are essential to its efficiency.
List of Figures/Illustrations

The following are defining and providing an image of commonly discussed terms in this report to ease reader interpretation.

Pallet: (image taken from Google)

TEU: Twenty Foot Equivalent Unit: (image taken from Google)
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Introduction

In the 21st century, global marketing and business came to become a key part of the world’s agriculture industry. In China, for example, citizens would rather buy fruit grown in America than in China even though they have a higher price. With global demand pressure fell on logistics to get product where it needs to be in a timely and cost effective fashion. With this new need, the birth of supply chain management became prevalent in many organizations. From private sector to public sector organizational entities pride themselves on having the quickest and least expensive methods of moving products across oceans, while maintaining quality. Based on popularity and exclusivity, having wine from other countries became very popular with consumers. The problem that the senior project is trying to solve is defining a supply chain system to transport wine from Italy to California at the lowest cost.

To give background on how this senior project came to be it becomes important to start by introducing the authors; Neil Magnuson, an industrial engineering major from Albany, California and Samuel Bucher, an agriculture business major from Lafayette, California, met in the dorms during their freshman year. After becoming friends they lived together the following year until Sam went on a trip to study abroad in Florence, Italy. It was in Florence where Sam lived with a young man by the name of Niccolo. Niccolo’s family owned a winery in Tuscany by the name of Travignoli. During his time at Cal Poly, Neil played on the rugby club team. It was during his time on the team that Neil met Nate Nunno. Nate was a San Luis Obispo native with a family business called Nunno wine storage. After much talk of undertaking an entrepreneurial venture combining these two connections, Neil and Sam decided to examine this business opportunity more closely. Neil and Sam decided it would be interesting to combine the curriculum of their majors and connections into a comprehensive multidisciplinary senior project: To design a supply chain from the begin point of Niccolo’s family’s winery in Tuscany to the end point of Nate’s family’s wine storage business in Paso Robles. At first, Neil and Sam set out with high hopes of actually starting this business instead of doing a project to create a framework for a hypothetical one. It wasn't until they realized the high barrier to entry in the wine business that forced them to pivot from an
entrepreneurial venture to a supply chain design. Although both elements are explored in depth in the analysis, this report more defines the framework for starting this business if, in fact one day, the two want to actually create a startup.

The following are objectives of this senior project:

- Investigate the wine supply chain industry
- Create a business plan for Bucher and Magnuson Importers Inc.
- Investigate what is required to become an importer/wholesaler of wine in California
- Define four hypothetical supply chains to get wine from a begin point in Tuscany, Italy to an end point in Paso Robles, California.
- Select an optimal supply chain based on the lowest cost.
- Based on demand for specific wines in the target market, properly allocate the bulk order to meet customer demand and in turn maximize profit.
- Redesign of the cold storage facility for optimal layout in Paso Robles
- Simulate a scaled supply chain on Simio using all the ports and processes within them.

The deliverables for this project include: A graphical representation of the hypothetical routes and the optimal one, an optimally allocated bulk order system based on customer demand, a business plan containing sales and operations, a facility redesign project on the end point warehouse, and a simulated model of this system.

This report will start with a literature review where the background, current techniques and future industry applications will be explored. The report will continue on into the design of the deliverables. After the design is discussed in depth, it will continue onto the methodology behind the experiments of the simulation. Finally, it will discuss the results of all the deliverables and end with concluding statements on what was learned during this project.
Literature Review

I. Introduction

A. Background

For hundreds of years Americans have been using technology to make things go faster. Whether it was old railway tycoons or modern day technology companies, all have made the process of getting somewhere faster. “The Council of Supply Chain Management Professionals (CSCMP) defines supply chain management as encompass[ing] the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies” (3). The term supply chain can pertain to anything that moves products from one place to another. From the creators of the Silk Road to Global Supply Chain Managers people have used sophisticated technological advances to make the movement of goods across these supply chains quicker and less complicated.

In the United States, Global Supply Chain is the one of the most important functions of a business. With the rapid increase of importing products at cheaper costs from other countries into the US, having an optimal global supply chain is key to staying afloat in competitive markets. As David Taylor puts it in his article, “The classic model of company vs. company is starting to give way to a new model: supply chain vs. supply chain. In the 21st century, being the best at producing or selling a superior product is no longer enough. Success now depends on assembling a team of companies that can rise above the win/lose negotiations of conventional trading relationships and work together to deliver the best products at the best price” (1)” Since this modern model of supply chain is so important to business, it is important to explore the history of supply chain and how it has moved toward this structure.

B. History of Technology and Supply Chain
The use of sophisticated technological advances have been used to broaden and grow supply chains for hundreds of years. Before supply chains existed, countries of people would only use the resources physically close to them when fueling business ventures. Take the earliest evidence of a supply chain, the Silk Road, which connected China, India, Java, Persia, Arabia, Somalia, Egypt and Europe allowed for the collaborative development of these countries with each other. Back then, the form of transportation was by foot and camel which was very slow.

It wasn't until the 1600s that a technological advancement came along, boats (2). The East India Trading Company used boats to trade spices with foreign countries. Although a simple example, boats provided for a technological advancement that ameliorated a supply chain. Now days there are tons of advancements in technology that drive down costs and lead times. Things like software and telecommunications make communication across multi-tier systems simple and efficient. The major characteristic of this literature review will be to explore what technologies can increase the efficiency of a particular supply chain, that of wine.

II. Current

A. Global Supply Chain

In today's global market, products travel more than most people do! “…consider the supply chain for T-shirts sold in the United States. The cotton used to make the T-shirts is grown in the United States and shipped to China where it is spun into thread and then woven into basic, generic T-shirts. The T-shirts are then shipped back to the United States where they are printed with logos or designs before they are sold. Think about that for a second. The T-shirts, in effect, make two trips across the world before they make it to store shelves or e-commerce warehouses. The Chinese labor must be cheap enough to more than compensate for the two transoceanic shipment costs, as well as the inventory holding costs on the shirts and the raw material, or else the entire production process would remain in the United States” (3). By land, water, air and road, products are moving across the planet.
Things like cheap labor and outsourcing have created for vast complex supply chains. Often times consumers only hear about brands like Apple and Nike without knowing about all the backend companies that make their products. There are huge tiers of companies that source these products all the way from raw material to consumer. Since most of these companies exploit labor in poorer countries to drive down costs, most supply chains are fraught with political issues: “Power asymmetries assure the dominance of Apple in price setting and the timing of product delivery, resulting in intense pressures and illegal overtime for workers” (4). Although in some cases unethical, today's competitive market drives corporations to make choices. Driving down costs and lead times are one way for companies to differentiate themselves to customers, and powerful supply chains are how they do it. All of the biggest companies of one’s generation will somehow use or contribute to global supply chain because it is what makes them most profitable.

Although the big users of global supply chain are usually technology products, many agricultural businesses have adapted to these models to increase profit and market size. After showing Cal Poly students on a plant tour the President of mission avocado remarked, “By setting up an avocado operation in Peru, we have increased market share significantly” (5). This is just one example of how the agricultural business sector is starting to migrate to adapting global supply chain.

**B. Wine Market Size**

Most people know someone who frequently drinks wine and occasionally consume themselves, but just how much wine does America consume? From 2010 to 2014 total consumption in the US has increased from 784 to 892 gallons, and the consumption per resident has increased from 2.53 to 2.8 gallons (6). Many would attribute this recent spike to the findings around wine’s benefit to one’s health. This increase in the past four years is extremely large and has been very profitable for some companies. As consumer’s palettes grow and competition increases, a new business model has started to emerge. People not only want locally grown wine but also would like to sample wine from abroad. The famous wine country of southern France attracts many consumers. Importing and distributing wine in the United States and especially in California is a growing business.
As far as California goes, production has ramped up: "The 2012 vintage will offer consumers in the growing national and international markets fantastic choices," said Robert P. (Bobby) Koch, President and CEO of Wine Institute. "The California winegrape harvest is estimated at 3.7 million tons, up from 3.3 million tons in 2011" (7). Not only is production and business in California ramping up, but also exports are taking a noticeable slide of wine inventory: “U.S. wine exports, 90% from California, reached a record high $1.55 billion in winery revenues in 2013, up 16.4% compared to the previous year, an increase for the fourth consecutive year by value. Volume shipments reached 435.2 million liters or 48.4 million cases, up 7.5%” (7)

In conclusion, the wine sector is growing, and with that comes an opportunity for implementation of different business models. Not only will companies make money from growing and bottling wine but also from importing and exporting it. With the importing and exporting business invites a new kind of player, inbounding and out bounding logistics, formerly known as supply chain management.

C. Wine’s Supply Chain

There is no doubt that now days it is considered stylish to enjoy wines from other countries: “...we witness a global wine supply chain which allows consumers to enjoy wine produced in different continents. For example, Canadians in 2010 consumed 336 million liters of wine, mostly imported Wine Institute (2013)” (9). But how do consumers obtain wine thousands of miles away? Just like any supply chain, the concepts from other businesses can be applied regardless of the product. As far as Italy goes, “It is the second largest wine producing country closely tailing France (8)”. Moreover, in terms of the United States, “Italy exports 32,290,000 cases of wine at a value of 1,063.8 million euros (8)”

From operations to logistics to supply chain, all wineries follow a similar end to end process: Grapes become wine and then it is bottled. After being bottled, wine is boxed, usually in crates of 12 (9). After leaving the winery, it is either trucked to a rail or to a port. Packaging is key: “Vibration causes a wine bottle to rotate 10 times per 600 miles of transit so special export shippers and dividers are necessary, or the use of “sleeves” for ultra premium bottles” (page 81, 11). Upon arrival at the port it is then loaded onto freight or plane and either shipped or flown.
An important thing to remember is that wine must stay cold the entire time. Trucks, rail, ships and storage warehouse’s all must have refrigerators to accommodate wine. Typically wine has different owners throughout its course. For example, a different person owns the crate while it is on the ship than after it clears customs. It is important for everyone in the supply chain to have the same quality standards. After leaving its country of origin and arriving to its destination, it must go through customs. It is not until it is picked up that it becomes the importer’s responsibility; let’s take the United States as an example: “In the United States, the key players in the alcoholic beverage industry make up a three-tier system and this three tier system is the law in most states. With respect to wine, the top-tier of this system is the winery or manufacturer that is producing the wine. Foreign manufacturers often obtain an agent who represents and acts on the winery’s behalf within the United States. This agent, called an “importer,” is licensed and authorized to bring wine into the United States from the manufacturer’s foreign country in the course of trade. The “importer” therefore may be considered to stand in place of the winery when referring to the top-tier of the three tier system.

The wholesaler or distributor represents the middle-tier. The wholesaler/distributor is the person or business licensed and authorized to purchase wine from the importer for resale. The wholesaler/distributor transports the wine purchased from the manufacturer or importer and resells it to the bottom-tier; the “retailer,” which is a restaurant, liquor store, or bar” (10).

This description sums up the typical inbounding operations once wine has reached the United States. The three tier system mentioned above is the way a lot of companies have been conducting business, but this review will explore ways of cutting out some of the steps to make it simpler and less inventory heavy, lean.

D. Legality

In order to become a wine importer/wholesaler, there are a few legal steps that must be taken. Often, foreign wineries acquire an agent that represents the winery and makes decisions on the winery’s behalf within the USA. The agent is referred to as an “importer”; he/she is licensed to bring the winery’s product into the USA from the product’s’ country of origin. In order to import wine this person must
obtain a license on the federal level. Generally he/she does not require any license on the state level. The FAA (Federal Alcohol Administration Act) requires the potential agent to obtain an Importer’s Basic Permit. In order to acquire this permit one must apply for it by attaching a Letter of Intent to his/her application and send it to the TTB (Alcohol and Tobacco Tax and Trade Bureau). On the Letter of Intent there must be a statement by the winery, or place of production, stating that it is intending to supply the potential agent with its wine. A signature from the foreign supplier with their letterhead is required for the Letter of Intent as well. The Letter of Intent is non-binding, meaning it does not create any responsibility to either party yet.

In addition, the TTB needs a Certificate of Label Approval (COLA) for each different type of product or each brand of wine that is being imported. Since the project is concerned with multiple wines, multiple labels are required before it enters interstate commerce. The application of the COLA is advised to be done as soon as the Importer’s Basic Permit is Obtained and the labels are ready for evaluation (10).

The following information is significant for this industry but does not apply to the project since the plan of import is from Italy: For some foreign countries, a certification is required to show that the processes used for production of the wine in the respective country comply with the the Miscellaneous Trade and Technical Corrections Act of 2004’s requirements. This Country of Origin Certification provides a statement from the respective country’s government with regards to results found from a lab analyses conducted on the wine. Also, the government must state that proper cellar treatment was employed. Throughout the years many countries have been exempt from this requirement: “Based on the enological agreement between the United States and the seven (7) countries listed below, natural grape wines containing 7 to 22 percent alcohol by volume imported from these countries are not subject to certification requirements: Argentina, Australia, Canada, Chile, Georgia, New Zealand, South Africa (13).

Based on the enological agreement between the United States and the European Union, natural grape wines containing 0.5 to 22 percent alcohol by volume imported from the twenty-eight (28) countries listed below are not subject to certification requirements:
Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, The Netherlands, United Kingdom (13)

The Importer’s Basic Permit does not allow the wholesale of wine. Many times an existing importer desires to become a wholesaler/distributor as well so that he/she can sell the wine once in the USA. In order to do this, he/she must apply for the appropriate wholesaler’s licenses on the Federal and State level. For this project, a Wholesaler’s Basic Permit from the TTB and an Application for a Wholesaler’s License from the [California ABC (Alcohol Beverage Control)] are required.

People who wish to become wholesalers as well as importers need not complete two separate permit applications. The applicant may check the proper boxes on his/her Importer’s Basic Permit application in order to combine both application documents. Once these permits have been obtained, the agent/wholesaler is ready to sell for each state he/she has been approved for. (Page 1, 10). (13).

Future

A. SCM Software’s Full Integration

Just as was seen with The East Indies Trading Company ameliorate the Silk Road with boats, how does modern day technology make companies faster in their supply chains. SCM Software, or Supply Chain Management software, has become a big part of almost all sectors of business. From production planning to customer facing, entire packages of these soft wares are being integrated into one package called ERP. It is important to see how the functionality of SCM software allows for business to communicate and plan effectively across tiers: “SCM is benefiting from relationship management software. Supplier Relationship Management (SRM) is a subsystem of SCM software and Customer Relationship Management (CRM) software has historically been a standalone system focused on sales force automation, marketing and customer service, however, is becoming increasingly more integrated with supply chain software” (12). The combination of all facets of business into one creates a process that
is always improving upon itself. This new adoption has been key to success in growing small and mid-size companies to huge brands the world knows today.

B. Wine Industry - What’s Next?

The main issue with today’s wine industry is that it is not integrated. As most supply chains for other products have made the push for vertical integration the wine industry has yet to. Although they communicate effectively, relationships like the retailers and distributors are often not managed correctly. Many discuss a shift from a supply driven to a consumer driven industry: “But the reality today is that it is the consumer driving the global wine industry; suppliers are no longer in the driver’s seat. High levels of production of both wine grapes and wine itself, and hyper competition from the seemingly ever-booming number of brands from around the world, have given the consumer an unprecedented level of power of choice at the retail end” (page 204, 11). To supersede competition, global wine businesses must adopt the model of supply chain management and a lean system. Instead of a heavy inventory laden system, companies should move toward a more lean pull system that decreases wait and moving times. Imagine a supply chain where retailers, distributors and wineries were on the same software packages meeting consumer demand. A company that could do this effectively would cut costs so much that they would be at the forefront of global wine business.

Design

In this section four different project deliverable designs will be covered. The first section of the report will go into detail on the inputs and logic of how the model was made for the supply chain. There are two parts in the supply chain: how the correct rate is decided upon and finally how the optimal allocation of the TEU was assigned. Secondly, the business plan will be discussed. It contains a high level sales/marketing and operations plans. Third, the facility redesign of the cold storage warehouse in Paso Robles. And finally, the simulation of the scaled model to meet future high demand volumes.
The Optimal Supply Chain

Bucher & Magnuson Importers Inc. is designing a Wine Supply Chain from Tuscany, Italy to Paso Robles, CA. The following routes have been chosen and from these the most optimal will be identified.

Route 1: Travignoli – Port of Livorno – Port of New York/ New Jersey – Paso Robles

The Port of New York/ New Jersey in New York is one of the biggest ports on the east coast of the United States. Since the wine is traveling East to West, the Port of New York/ New Jersey was immediately thought of as a potential node for the supply chain. After doing some research it was decided to use this port as one of the potential routes because of their innovative environmental initiatives as well as their rich history of successful imports. Also, since New York and California are two of the biggest states in America it was assumed that there would be a well-defined and therefore cheaper priced trucking route between them.

Route 2: Travignoli – Port of Livorno – Port of Baltimore – Paso Robles

The Port of Baltimore is one of the biggest ports on the east coast of the United States. After doing some research it was decided to use the Port of Baltimore because of its size and capability of receiving many types of cargo. Using the Port of Baltimore also provided the straightest route of the TEU from the begin point and end point. It is understood that there is civil unrest currently going on in Baltimore that could cause issues for the port. This risk is beyond the scope of the project.
**Route 3:** Travignoli – Port of Livorno – Port of Long Beach – Paso Robles

Modes of Transportation: Reefer Truck – Deep Sea Carrier – Reefer Truck – Rail – Reefer Truck OR
Reefer Truck – Deep Sea Carrier – Reefer Truck

The port of Long Beach is one of the two biggest ports in California. Since the supply chain ends in Paso Robles, CA, Long Beach becomes an ideal place to import into. The Port of Long Beach is the second busiest container port in the United States. This port is capable of handling the product in a very efficient way. However, California Ports have had a recent history of strikes that have caused supply chain delay and a lot of products to perish. Although this is a recognizable risk this is beyond the scope of the project.

**Route 4:** Travignoli – Port of Livorno – Port of Oakland – Paso Robles

Modes of Transportation: Reefer Truck – Deep Sea Carrier – Reefer Truck – Rail – Reefer Truck OR
Reefer Truck – Deep Sea Carrier – Reefer Truck

The port of Oakland is the other of the two biggest ports in California. The same logical reasoning as Long Beach was used in the choosing of this port.

The following images are simplified graphical representations of the routes:

*Internationally:*
Domestically:

Model Inputs:
After defining the nodes, the next step was defining what inputs would go into the decision of which port to choose.

- Target market: San Luis Obispo County
- Production plant: 1, Tuscany
- Suppliers: 1, Travignoli
- Potential Warehouse Locations: 1, Nunno Wines
- Demand at San Luis Obispo: Extrapolated from Survey.
- All of the fees associated with each supply chain

**Procuring Data for Shipping Costs:**

The [www.searates.com](http://www.searates.com) website provides a platform for people to negotiate shipping rates and logistics. From this website, routes 1, 3, and 4 became quoted. Some of the quotes were not for Reefers, refrigerated containers, or only contained part of the total supply chain. Although these numbers provided good background for a ballpark estimate, more realistic quotes from a legitimate company were desired.

Phil Morsing, Vice President of National Operations at Southern Wine & Spirits and Cal Poly Alumni provided full supply chain quotes for all four routes, every cost at every step along the way. He supplied the total time it took for the entire supply chain. Although total time is a useful metric, the times at each step in the process were needed to run an optimization function, not just total time. It wasn't until further inquiry that it was discovered that this information is extremely variable and therefore unable to be listed. The following is the excel document containing all the costs associated with each route from his email:
Description of Shipping Costs

These quotes are if Southern Wine & Spirits was contracted to ship 1 TEU of the product, so the following costs are in the units of dollars per TEU. Below are the definitions from the quote sheet above:

*Ex Works Trucking*: Contracted Trucking from Ex Works Trucking. This is a one-time cost Ex Works Trucking Inc. charges for getting the wine from Travignoli to the Livorno Port.

*Export Customs*: This is the cost to get the shipment out of Italy into international waters via customs.
*Ocean Freight:* This is the cost to ship 1 TEU (16 Pallets) of the product from the port of Livorno to each port.

*BAF:* This stands for Bunker Adjustment Factor. It is an adjustment to the shipping rate taking into account the fluctuations in the cost of fuel oil (bunkers) for the ship.

*Cross Dock w/ DRAY:* Drayage is the transport of goods over short distance. In this case, it is the transport of the goods from the truck to the ship. This is the cost of cross docking with drayage at the port of Livorno. Cross Docking is a logistics strategy used for saving time and increasing efficiency. When the delivery truck arrives at the destination, a receiving truck/ship/train is ready for pickup immediately, eliminating the need for the product to be stored before travel.

*Panama Canal SC:* This is the amount of money that must be paid for routes 3 & 4 for the ship to cross the Panama Canal from the Atlantic Ocean into the Pacific Ocean.

*US- THC:* This stands for Terminal Handling Charge. This charge is collected by terminal authorities at each port for handling products as well as maintenance of products. In the case, the United States charges for the product entering each port.

*Chassis Surcharge:* A chassis is a distinct trailer or undercarriage used to transport ocean containers over a road. The cost of using one of these trailers is included in the total shipping expense.

*Security Doc Fee:* This is a security fee that must be paid for the products. There is a requirement for electronic transmission of Entry Summary Declarations (ENS) for exports or imports to or from the European Union.
Bill of Lading Fee: A Bill of Lading is a document published by a carrier which details the shipment of products and provides the title of the shipment to an indicated party. This insures that importers receive their product.

IPS: A Fee for the services of the International Parcel Services.

Land Bridge/ Rail or OTR: OTR stands for Over the Road; over the road truckers are ones that travel over weeks at a time. Land Bridge signifies the transport of containers by rail between ports on either side of the country. This is the cost of one of these two modes of transportation from the Ports of NY/NJ or Baltimore to Paso Robles, CA for routes 1 & 2.

Sulfur Fee: This is a fee that the carrier collects in response to new low-sulfur environmental regulations. This environmental regulation required shippers to switch to low sulfur fuel.

US Inland/ Drayage: This is the cost of getting the product from Oakland/ Long Beach to the warehouse in Paso Robles for routes 3 & 4.

Port Security: This is an additional charge for security documentation.

ISF: This stands for Importer Security Filing. This rule requires shippers of cargo that is in a container to provide information for security purposes before goods come into the USA.

US Customs Broker: This is a fee that is paid to hire a broker who is licensed by US Customs and Border Protection to conduct CBP (Customs & Border Patrol) business on the behalf of importers. These people will fill out paperwork and obtain a CBP bond for us in exchange for cash.
Additional Comments Transit Days to Door: Here is listed how many days it takes each route to get to the final destination of Paso Robles.

TEU Allocation

In this section of the design, the data manipulation tactics of how the optimal load was decided upon will be discussed. One thing that is important to disclose is the total amount of cases that were being shipped: 1 TEU = 16 pallets * 56 cases per pallet = 896 cases.

After deciding that 1 TEU full of wine is the unit load, next it was decided which wines and how much of each wine will be inside the TEU under the assumption that each pallet could contain all of one wine or some of one wine and some of another.

The proper allocation was commenced by reading a senior project done in 2013 by an agribusiness major, Jacob Clinite. His project is called, *The preferences in Wine of Various Aged Consumers*, and provided the TEU allocation framework with valuable data that could be manipulated to solve the problem of the optimal allocation of wines in the load.

*Step 1*: The team started by finding demographic data in the city of San Luis Obispo. Using ages 21+, the percentage of each age group was determined (5 year intervals) by dividing the population in each age group by the total population in San Luis Obispo. This allowed the team to better understand the proportion of age groups relative to the whole population of San Luis Obispo.

*Step 2*: The tables and graphs done by Jacob Clinite used data from a survey completed by 115 individuals in the area (Shown Below). The percentages of age groups in his data did not reflect the percentages of data found using real San Luis Obispo demographics. Knowing this, the data was scaled to the real demographics proportionally with Jacob’s data. After doing this, Jacob’s survey data was used on the preferences of which wine each age group likes to scale to the population pool of the whole city of San Luis Obispo (17).
Step 3: Jacob’s report provided the project with a table of data showing how much of each of the 6 wines in his project are consumed monthly by his pool of 115 people surveyed in San Luis Obispo (Shown Below). His table included Cabernet Sauvignon, Merlot, Syrah, Chardonnay, Pinot Grigio, and Pinot Noir. Since Jacob’s report provides generic types of wines, four of his six genres were translated to four specific wines that Travignoli produces. TRAVIGNOLI TEGOLAIA I.G.T. TOSCANA converts to Cabernet Sauvignon since it is a blend of 70% Sangiovese and 30% Cabernet Sauvignon. CALICE DEL CONTE I.G.T. TOSCANA translates to Merlot since it is a blend of 70% Merlot and 30% Cabernet Sauvignon. VILLA TRAVIGNOLI CHIANTI RUFINA D.O.C.G., one of the brands most notorious wine made from 100% sangiovese grapes, can be construed to Syrah since the two grapes have a similar look and taste. Finally, GAVIGNANO I.G.T. TOSCANA can be translated to Chardonnay since it is a blend made from 90% Chardonnay and 10% Sangiovese grapes. It is understood that these Travignoli wines do not perfectly mirror the generic wines from Jacob’s data but for the sake of the project and determining the optimal TEU load, the assumption is made that they are the same (17).


**Step 4:** For each genre of wine, the individual participants selected how much they drink each month by choosing *do not drink, drink rarely, drink regularly, and drink very frequently*. For the four wines that the project is concerned with, the percentages the table provided for *drink rarely, drink regularly, and drink very frequently* were turned into real numbers by multiplying the percent by the San Luis Obispo population for each age group. This allowed us to extrapolate Jacob’s survey of how many people out of 115 participants like to drink each wine to how many people like to drink each wine in the city of San Luis Obispo (based on Jacob’s surveyed percentages of age groups).

**Step 5:** The new table was weighted in order to create tangible numbers that could then be used from Jacob’s abstract wording of *drink rarely, drink regularly, and drink very frequently*. At this point, the table contained the numbers for how many people in each age group *drink rarely, drink regularly, and drink very frequently* for each type of wine. Essentially, the weighted table has 3 numbers for each type of wine in each age group; by weighting the table the data condensed the 3 numbers for each type of wine into 1 number for each type of wine in each age group. Each *drink rarely* was multiplied by the number 0.1, each *drink regularly* was multiplied by the number by 0.3, and each *drink very frequently* was

<table>
<thead>
<tr>
<th>Varietal</th>
<th>do not drink</th>
<th>drink rarely</th>
<th>drink regularly</th>
<th>drink very frequently</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabernet sauvignon</td>
<td>7.1%</td>
<td>36.3%</td>
<td>32.7%</td>
<td>23.9%</td>
<td>100%</td>
</tr>
<tr>
<td>Merlot</td>
<td>8.9%</td>
<td>42.9%</td>
<td>41.1%</td>
<td>7.1%</td>
<td>100%</td>
</tr>
<tr>
<td>Syrah</td>
<td>13.0%</td>
<td>49.1%</td>
<td>28.7%</td>
<td>9.3%</td>
<td>100%</td>
</tr>
<tr>
<td>Chardonnay</td>
<td>14.0%</td>
<td>44.7%</td>
<td>29.8%</td>
<td>11.4%</td>
<td>100%</td>
</tr>
<tr>
<td>Pinot Grigio</td>
<td>23.0%</td>
<td>50.4%</td>
<td>20.4%</td>
<td>6.2%</td>
<td>100%</td>
</tr>
<tr>
<td>Pinot Noir</td>
<td>9.8%</td>
<td>47.3%</td>
<td>32.1%</td>
<td>10.7%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Clinite, 2013
multiplied the number by 0.6. For each type of wine in each type of age group the three numbers that this weighting provided us with were summed, giving us a brand new number that represents how many people are going to buy each type of wine in each age group in a month.

*Step 6:* Since the data was extrapolated on the grounds that Jacobs surveys’ age group population percentages, it still needed to be manipulated. The data needed to be reverted back to real San Luis Obispo age group population percentages. This was done by dividing the brand new number that that represents how many people are going to buy each type of wine in each age group by the total population in each age group (based on Jacob’s data, giving us a percentage) and multiplying this percentage by the real San Luis Obispo demographics data population in age group. This is how the data was scaled back to the real city proportions of the population from Jacob’s survey proportions of age groups.

*Step 7:* At this point, a table was created: All units are the number of people in San Luis Obispo who drink those wines every month.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Cabernet Sauvignon</th>
<th>Merlot</th>
<th>Syrah</th>
<th>Chardonnay</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-25</td>
<td>2819</td>
<td>2070</td>
<td>977</td>
<td>2007</td>
</tr>
<tr>
<td>26-30</td>
<td>1067</td>
<td>783</td>
<td>370</td>
<td>760</td>
</tr>
<tr>
<td>31-35</td>
<td>616</td>
<td>452</td>
<td>213</td>
<td>438</td>
</tr>
<tr>
<td>36-40</td>
<td>514</td>
<td>377</td>
<td>178</td>
<td>366</td>
</tr>
<tr>
<td>41-45</td>
<td>507</td>
<td>372</td>
<td>176</td>
<td>361</td>
</tr>
<tr>
<td>46-50</td>
<td>596</td>
<td>437</td>
<td>206</td>
<td>424</td>
</tr>
<tr>
<td>51-55</td>
<td>658</td>
<td>483</td>
<td>228</td>
<td>469</td>
</tr>
<tr>
<td>56-60</td>
<td>652</td>
<td>479</td>
<td>226</td>
<td>464</td>
</tr>
<tr>
<td>61-65</td>
<td>311</td>
<td>228</td>
<td>108</td>
<td>221</td>
</tr>
<tr>
<td>66-70</td>
<td>216</td>
<td>158</td>
<td>75</td>
<td>154</td>
</tr>
<tr>
<td>71+</td>
<td>1100</td>
<td>807</td>
<td>381</td>
<td>783</td>
</tr>
</tbody>
</table>

Since this table was made after extrapolating Jacob’s market survey data, the proper allocation of the TEU to meet this demand of San Luis Obispo wine drinkers could be made. Next, how many people
that drink each wine were totaled: **Cabernet Sauvignon** - 9,054 people **Merlot** - 6,647 people **Syrah** - 3,139 people **Chardonnay** - 6,447 people. The team then divided each by the total number of San Luis Obispo wine drinkers. Giving us these percentages: **Cabernet Sauvignon** - 35.8% **Merlot** - 26.3% **Syrah** - 12.4% **Chardonnay** - 25.5%. Considering that the TEU consists of 896 cases (56 cases per pallet, 16 pallets) the percentages were multiplied by 896 to determine how many cases of each wine should be in the TEU. After translating each genre of wine to a specific Travignoli wine, the optimal product allocation for the TEU are as follows:

<table>
<thead>
<tr>
<th>Wine Type</th>
<th>Proper Allocation of Travignoli Wine in 1 TEU to Meet Market Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRAVIGNOLI TEGOLAIA I.G.T. TOSCANA</td>
<td>Cases 321</td>
</tr>
<tr>
<td>CALICE DEL CONTE I.G.T. TOSCANA</td>
<td>236</td>
</tr>
<tr>
<td>VILLA TRAVIGNOLI CHIANTI RUFINA D.O.C.G.</td>
<td>111</td>
</tr>
<tr>
<td>GAVIGNANO I.G.T. TOSCANA</td>
<td>228</td>
</tr>
</tbody>
</table>

*All units from the above table are in cases of wine

**Business Plan Design**

The business plan design was done using a combination of a template from Lexi Consulting, a previous employer of Sam, as well as what Sam has learned through some of his Agricultural Business classes. This project aims to address these questions in the Business Plan:

What need does your business satisfy?

How does your business satisfy these needs?

Who are your competitors?

What state is your market in right now?

Who are your customers?

How much money is required to get your business started/ Break-even?

What are your goals?

Why are you starting this business?

The Company Overview section is a brief analysis of what type of company the enterprise is, what the goals are and how the company was founded. The Business Opportunity section investigates
why the company will succeed, and what we plan to do with the company. The Product subdivision explains in detail what the products/services are. It explains where the product comes from as well as the expected pricing of the product. In addition, the product section provides brief history about the product and the area it was grown. This was contributed using previous knowledge of the product as well as research about the product. The Marketing Plan illustrates where we plan to sell the product and how well we expect it to do. This section also lists the competitors and the competitors’ prices. The marketing plan data was procured using research. The Operations plan explains how we will provide the services by completing the supply chain. It shows the expected modes of transportation and planned routes. The Leadership section furnishes the Business Plan with background on the owners of the business. It illustrates how the owners came to meet, and what experiences led them to where they are now.

Facility Design

It was decided that since hypothetically there would be a lot of fulfillment from the selected storage facility in Paso Robles, CA it would be pertinent to redesign and configure it for optimal use based on their processes. Although one of the group members, Neil, was on this team it is important to note that this was a project for another class, IME 443.

From the image below of the original facility design it is easy to see that it lacks organization and is potentially unsafe. Using concepts and methods used in their class the IME 443 team redesigned this facility and propose to solutions to Nunno Wines. The solutions are based on modeling the facility based on optimal designs for their processes.
Scalable Simulation

This Simio system model was designed under the assumption that the business is growing and therefore requires to be scaled to meet higher demand volumes. In essence, the products were a big hit in the market and experienced high demand. It is important to note that although based on the senior project, this project was done for another class with another team, IME 420 (Neil was a part of this team). The 420 team designed this model based on the assumption that they would use all four ports and scale their model based on weekly shipments.
The above image is a model of the wine supply chain system being modeled by Simio modeling software. This design will be used to identify bottlenecks and capacities of the full scale model. An import thing to note is that the wine flows through the least overloaded server. A couple assumptions were made during the above simulation model’s creation. The port of Livorno being a “source” provides the assumption that the Travignoli winery can keep up with the demand regardless of what it is. The Paso Robles warehouse is a “sink” assumes that the warehouse can hold an infinite amount of inventory, so once the TEU’s reach the sink they dissipate from the system to customer demand.

Without going into too much detail about the specifics of data on each node and time path the important ones will be highlighted. The Livorno Port of Italy source will output deep sea carrier ships containing 1 Reefer TEU based on random distributed number sets where the week's decrease overtime. There will be a 1 year, 2 year and 3 year plan. Each year, the time between shipments will decrease, simulating scaling demand and increase in market share. The Deep Sea Carrier will go to to the port and then dissipate the system through a sink. At each port, it is simulated that the TEU is unloaded from the deep sea carrier via a crane and placed to an unloading dock, there are process and load times associated with this process. After 16 wine pallets are unloaded from the TEU they are then transported to a cold
storage truck via a forklift that can only take 2 pallets at a time. Again, there are process and load times associated with these paths. After the truck is loaded, the wine is then transported to Paso Robles before dissipating the system. All of the total times and costs are inputted into the model from Phil Morsing’s excel sheet.

**Methods**

Our supply chain model was built under the assumption that this was a lean launch and in reality only 1 TEU would be imported to test the business in the target market. This being true, primarily only cost is the concern. The facility design, TEU allocation, and business plan are hypothetical, and therefore no prototype can be tested or experimented on. Thus, the only deliverable of the project that is testable and has the functionality for experiments to be run on it is the simulation model. This section will explore the effect of cost versus time of the simulation model under the assumption that the business was scaled to meet high customer demand volume.

**Experimentation of Scalable Simulation**

After designing this model, one could run experiments on it to test the validity of the system. The control that monitored the system was set up on the inter-arrival time of the source, or how many units were being inputted into the system at one time. Being able to manipulate and monitor how many units were being put into the system allowed our experiment to simulate growing demand. For the scenarios of the experiment, Year 1, Year 2, and Year 3 were used. Below is the design of the experiment that was run on our model:
As one can see from the table, the experiment controlled the inter-arrival time of the source. All units were converted from days to minutes for model simplicity. As time from year 1 increased, the demand, or units inputted into the system increased. This is shown by making the parameters of the distribution closer and closer together as time goes on. This in turn means that there is less and less time between arrivals and therefore more and more units inputted into the system, simulating growing and growing demand uniformly from year to year. The responses on the right are what is being monitored by changing the control on the system. This will be used to evaluate of the system is performing based on our controls.

**Results and Discussion**

In this section of the report the resulting deliverables from the design section are presented and discussed. Potential problems are acknowledged and examined for further analysis.

**The Optimal Supply Chain**

Since the design followed the assumption that only one TEU would be ordered to meet initial demand, the solution was simply an addition problem: adding up the costs incurred during every step in the process of each potential supply chain and deciding on the cheapest one, Long Beach. The results were not as expected. Originally when designing the nodes, the team thought that sending the shipment through Baltimore would be the fastest and cheapest. This hypothesis was formed on the basis that it is follows the straightest line from Italy to California. Moreover, this hypothesis was formed because of the long routes the deep sea carriers had to take to the ports in California, Long Beach and Oakland, which
must pass through the Panama Canal. Upon receiving the excel spreadsheet modeling the costs incurred from each supply chain from Phil Morsing, it was easy to see that although taking almost the longest time, the Port of Long Beach was the cheapest by a considerable amount. Having no previous knowledge of shipping costs, Neil and Sam had no idea on how much shipping costs were but guessed in the range of $5,000-10,000. The cost of the Port of Long Beach being $7662 ended up being right in the middle. The following is a graphical representation of the optimal supply chain: (the following images were taken from google images)

There are a couple technicalities associated with the supply chain but one stands out, the problem of not being able to weigh the effects of cost versus time. Originally upon the inception of this senior project we wanted to find the cheapest and fastest supply chain. Since certain data, time to unload from deep sea carrier to truck, or time spent in the water before being able to dock at port, were so variable and almost impossible to find, the team had to come to the solution of just using cost in their analysis. Although simplifying the problem, the team finds that it is actually more realistic because when in the initial phases of starting a business, lead times are only discussed during future scaling, which are explored in our simulation system model.

Upon the thoughts of implementation, this venture proves to be profitable. After incurring the shipping and product cost, the exact financials are discussed in the business plan below. In terms of potential problems that could crop up, the volatile nature of California port work forces is always a
concern. It is common for ports to go on strike. When this happens, product can sit in the water for weeks and go bad, which is a legitimate problem.

**TEU Allocation**

<table>
<thead>
<tr>
<th>Wine Type</th>
<th>Proper Allocation of Travignoli Wine in 1 TEU to Meet Market Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRAVIGNOLI TEGOLAI A I.G.T. TOSCANA</td>
<td>Cases</td>
</tr>
<tr>
<td>CALICE DEL CONTE I.G.T. TOSCANA</td>
<td>Cases</td>
</tr>
<tr>
<td>VILLA TRAVIGNOLI CHIANTI RUFINA D.O.C.G.</td>
<td>Cases</td>
</tr>
<tr>
<td>GAVIGNANO I.G.T. TOSCANA</td>
<td>Cases</td>
</tr>
</tbody>
</table>

This design is a good one because it provides the optimal TEU allocation of four types of wines that Travignoli produces. The allocation that has been decided meets market demand as well efficiently consolidates the four products into one full TEU which in turn maximizes profits. Without the exact market data for these specific Italian wines, the assumption that the generic wines from the survey relate directly to the Italian ones could be seen as problematic. We recommend analyzing how well market demand was met and allocating future TEUs to meet the change in market as time goes on. It is expected that market demands will change, thus optimal TEU allocations will change. Manipulation of data should be limited in the future, it is important to spend time on trying to find real direct data for the wine. A survey of these wines would be a good idea for the future.

**Business Plan**

*Company Overview*

Bucher & Magnuson Importers Inc. is a privately held importer/wholesaler of Italian wines. The plan is to establish an international supply chain beginning in Tuscany, Italy and ending in Paso Robles, California. The company was founded by Sam Bucher and Neil Magnuson during their senior year at
California Polytechnic State University. This Business Plan/Supply Chain model was done as their senior project.

**Business Opportunity**

We understand that California is home to some of the best wineries in the world. That said, there is also a strong demand for classic European wines. We believe there is a market for Chianti Rufina in the Central Coast as there are an abundance of Italian and Continental restaurants which would welcome the opportunity to expand their wine lists. The objective is to create a business that handles all steps of the wine supply chain from exporting in Europe to wholesaling in California. In addition we plan to find the best markets in California for the Italian wine we represent, Via Travignoli, and distribute accordingly. The initial plan is to import only Italian wines; but we are leaving the plan open to the possibility of importing other European wines once we have established a working supply chain.

**Product**

Wines from Travignoli are bold and satisfying and made in the Toscana region of Italy which can sell for a relatively modest price. The pricing model can be adjusted based on costs and market opportunity once we gain more experience. The Tuscany territory is home to soils that are majority marl and chalk. The area is a bit more mountainous than the Chianti Classico region. The vineyards range up to 2,950 feet in elevation. Since the nights in this region are a bit cooler than the Classico zone, these Rufina grapes ripen slower, cultivating a greater concentration of flavor.

In English, Travignoli can be interpreted as “through the vineyards”, because of the maze of vineyards you must surpass to arrive at the main house. Villa Travignoli is located 15 miles northeast
of Florence and spans 222 acres. The now owners have family owned this site since the 1700s, however the property dates back to the 12th century (20).

In this section of the business plan are two pictures of Sam at Villa Travignoli in Italy. The pictures were taken in 2013.

Marketing Report

As well as being one of the fastest growing markets for wine production and consumption, The United States of America is also the leading retail wine market in the world. The reason for such rapid growth in the past years is because of increased consumption, government support, the development of online wine sales markets, and a growing younger population infatuated with wine.

Currently, over 100 million people in the USA drink wine. Last year (2014) the USA consumed 339.6 million cases of wine; this is expected to increase by 11.3% to 377.9 million by 2018. Spearheading the world, the USA consumes $29.5 billion of wine and forecasted to increase to $33.2 billion by 2018. However, specifically speaking on red wine, the USA is slightly behind France in consumption, and second to Italy in white wine consumption. By 2018 the USA is projected to be the top consumer of red and white wines worldwide.

In terms of per capita, the USA is behind Europe, consuming about 10 liters per head. Italy consumes about 48 liters per head, France consumes about 47 liters per head and the UK consumes about 24 liters per head. Nevertheless, wine per capita is increasing in the United States and declining in most
European countries. Below is a graph representing each generation and their fine wine buying trends. The baby boomers lead sales in fine wine and Gen X has the second largest market share (18).

![Year-over-year sales trends in fine wine](image)

In 2015, exports of Italian wine to the United States are predicted to surpass 1.7 billion dollars in 2015. Italy is currently the head exporter in the USA. Last year (2014) the USA imported 1.3 billion dollars’ worth of Italian wine from Italy, which is about 2.4 million hectoliters. The country remained the lead in exports to the USA by limiting a rise in prices last year. It is expected that wine within the price points of $10 to $20 per bottle will see the greatest consumer demand. However, 2015 will permit some increase in bottle prices to be above the $20 price point. Below $8 per bottle retail is considered the lower end of the market. This section of the market is trending down. Since the value of the dollar is
strengthening, bulk imports may increase. If this is the case, the lowest end of the market may see price discounting and possibly volume declines as well in 2015. Still, in the $10- $20 price point part of the market there is a lot of wine to be sold. The graph below shows the future price expectations of different priced wines (18).

The next graph shows the Sales Share in the USA based on generations. Baby boomers take the most market share in every price (18):
Brian Larky is the founder of an Italian Wine import company called Dalla Terra, he was interviewed by the wine review providing some great industry insight: The sales of Italian wines are still astonishing in the United States and that is not expected to change. While French wines have seemed to have priced themselves out of the US market, Larky seems to think that Italy is in a superior position to respond to unpredictable demands in the market. This is because Italy provides more reasonably priced quality wines (19).

Sales Plan

Our target selling market is the San Luis Obispo area. The product sells very well in the Eastern United States and the mission is to find similar markets in California. We predict the market opportunity will come from restaurants, specialty grocers and wine shops serving upper middle class families in the 30 to 80 year age range. The competition is Nipozzano Chianti Rufina, which sells for $45.00, Chianti Rufina which sells for $22 and Bastardo Sangiovese di Toscana which sells for about $8 dollars a bottle.

Dalla Terra, an American company that imports and sells Italian wines in California to wholesalers is also our competitor for our importing services.

Operations Plan

In order for us to create the optimal supply chain from Italy to California, we must determine the ideal route. We will define the ideal route by taking into consideration transportation price and market demand in California.

Considered Routes

Travignoli - Livorno - Baltimore - Paso Robles
Travignoli - Livorno - New York/ New Jersey - Paso Robles
Travignoli - Livorno - Oakland - Paso Robles
Travignoli - Livorno - Long Beach - Paso Robles
Considered Modes of Transportation

Trucking

Rail

Reefer Carrier

The cheapest route from above was find to be through the Long Beach Port, and that is the route that Bucher & Magnuson products will take.

Finances

Travignoli sells wine in the east coast of the United States. The going merchant rate (wholesale) for a case of Gavignano I.G.T. Toscana is about $172.68. A wholesaler that sells for $172.68 a case can expect to buy from an agent at $129.51. An agent that sells to distributors at $129.51 a case can expect to buy from a winery at $103.61 a case. The going merchant rate (wholesale) for a case of Villa Travignoli Chianti Rufina DOCG per case is about $190. A wholesaler that sells for $190 a case can expect to buy from an agent at $142.5. An agent that sells to distributors at $142.5 a case can expect to buy from a winery at $114 a case. The going merchant rate (wholesale) for a case of Travignoli Tegolaia I.G.T. Toscana is about $280.00. A wholesaler that sells for $280.00 a case can expect to buy from an agent at $210.00. An agent that sells to distributors at $210.00 a case can expect to buy from a winery at $168.00 a case. The going merchant rate (wholesale) for a case of Calice Del Conte I.G.T. Toscana is about $209.30. A wholesaler that sells for $209.30 a case can expect to buy from an agent at $156.98. An agent that sells to distributors at $156.98 a case can expect to buy from a winery at $125.58 a case. In order to get the wine to Paso Robles using the cheapest strategy via the port of Long Beach, it will cost a total of $7,662. Nunno wines charges $0.17 per case to store for a month. It is assumed that it will cost $152.32 per month to store all cases. In addition, Nunno wines charges a fee of $.50 to take out each case from the storage facility. This creates an additional cost of $448 in order to take out cases for sale to retailers (14,15,16).
Assuming that these are the going wholesale prices for each of these wines per case and assuming that it is possible to sell all cases in one month, the following table provides the break-even point as well as the total expected profit for 1 TEU of the optimal combination of Travignoli wines.

<table>
<thead>
<tr>
<th>Wine Type</th>
<th>Agent Cost per Case</th>
<th>Wholesale Price per Case</th>
<th># of Cases in TEU</th>
<th>Total Cost per Wine</th>
<th>Total Revenue per Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAVIGNANO I.G.T. TOSCANA</td>
<td>$103.61</td>
<td>$172.68</td>
<td>228</td>
<td>$23,623.08</td>
<td>$39,371.04</td>
</tr>
<tr>
<td>VILLA TRAVIGNOLI CHIANTI RUFINA D.O.C.G.</td>
<td>$114.00</td>
<td>$190.00</td>
<td>111</td>
<td>$12,654.00</td>
<td>$21,090.00</td>
</tr>
<tr>
<td>TRAVIGNOLI TEGOLAIA I.G.T. TOSCANA</td>
<td>$168.00</td>
<td>$280.00</td>
<td>321</td>
<td>$53,928.00</td>
<td>$89,880.00</td>
</tr>
<tr>
<td>CALICE DEL CONTE I.G.T. TOSCANA</td>
<td>$125.58</td>
<td>$209.30</td>
<td>236</td>
<td>$29,636.88</td>
<td>$49,394.80</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>$119,841.96</td>
<td>$199,735.84</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shipping Cost</th>
<th>Storage Cost</th>
<th>Service Cost</th>
<th>Total Cost</th>
<th>Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$7,662.00</td>
<td>$152.32</td>
<td>$448.00</td>
<td>$128,104.28</td>
<td>$71,631.56</td>
</tr>
</tbody>
</table>

**Leadership**

Sam Bucher is a California native and Agricultural Business major at California Polytechnic State University in San Luis Obispo. Sam’s interest in Italian wine began during his junior year when he studied in Florence, Italy. During this time he spent time at the small winery of one of his Italian friends. It was during this time that the vision for this business developed. Sam did a fall harvest internship at J. Lohr winery during his senior year to gain additional knowledge and experience in the wine business.

Neil Magnuson is an Industrial Engineering major at California Polytechnic State University in San Luis Obispo. He has experience in Operations Research and Supply Chain Applications from his schooling as well as a Gap Inc. internship. It was through teammates from college whose families owned wineries that started Neil’s interest in the wine industry.

During their senior year, Sam and Neil took a class called BUS 304 Establishing International Supply Chains. For spring break the whole class went to Shanghai, China to tour many supply chain businesses as well as meet with several successful global business people. This experience allowed the
two to get a primary view of the big picture in the supply chain industry. Also during this experience they were exposed to the booming Chinese wine market and learned how current demand is increasing.

**Facility Design**

The 443 team came up with a way to classify inventory based on pick frequency as an optimal layout based on the work processes performed. The 443 team also organized the facility using 5S concepts.

*Solution 1: Inventory Classification ABC:* The facility is 100 feet by 140 feet.

![Diagram of facility organization](image)

The image above shows a two dimensional view of how the facility would look once organized. Although one cannot tell from this image the 443 team defined a module that they then extrapolated to fit the entire facility. The module contained a width of 60 inches, 40 for the pallet and 20 for the worker. The length of the module was 7 pallets long or \(7 \times 48\) inches per pallet = 336 inches or 28 feet. These modules were defined and scaled to find the total capacity of the warehouse. After the modules were defined the inventory was classified based on picking frequency. The items that were picked the most were classified
as A items and were placed toward the front and easiest for the forklift to get to. The B items were placed in the middle were picked sometimes and in the middle of the module. Finally, the most rare picked vintages and varietals were toward the back of the module. Although picked the least, the C list items are the hardest to get too, often taking the worker from 45 minutes to an hour to get. Below is a 3D image of what the proposed solution looks like:

Some potential problems with the new layout is dealing with change. Customers, varietals and wine popularity change from month to month. An accurate up to date ABC classification must be maintained in order for this system to be kept in place.

**Scalable Simulation**

A lot of logic was put into this model in order for it to perform in the desired way. The entity, the TEU, was routed to the ports first on cost, choosing the cheapest one, and secondly, by least overloaded. For example, the first entity into the system will go to Long Beach because it is the cheapest, but the fourth wont, because Long Beach, since it has the longest lead time, is over loaded. It will instead go to New York, which although is the most expensive, is the fastest. With the logic inputted into this model, the team could weigh the effect of cost verses time: All units are in number of model entities.
The responses on the right are what is being monitored by changing the control on the system. This will be used to evaluate of the system is performing based on the set controls. The first response, Number In System, models on average how many TEU’s are in the system at a given point in time. As demand increases and time goes on, the average number in system at a given point in time increases accordingly. The second response, Throughput, models the amount of TEU’s that dissipated from the system in that year. Again, as time increases the throughput of the system goes up. Both of these metrics are useful to see that our model runs properly, but not useful to use when comparing the ports in the system to see which one is optimal. The last four responses are abbreviated for each ports throughput, in other words how many entities ran through this port for the given year. As you can see from the numbers above, it is easy to see that as time goes on and demand goes up, New York and Baltimore are used more frequently than Long Beach and Oakland. This increase in the expensive ports use is because the lead times to send product through Oakland and Long Beach are just too long and the system requires sending it through the more expensive ones, which are utilized more.

By weighing the effect of cost verses time, New York becomes the optimal port to send product through because it is the least overloaded the most of the time. It has the highest number of units allocated and flowing through it. After factoring in time into the real world issue of supporting a growing business, the conclusion can be drawn that New York is the new optimal port. The 420 team recommends that after scaling this business, the operations team focuses on New York as the optimal port rather than Long Beach to get product delivered on time.
Conclusion

The original intent of this project was to create a framework for a business that two friends might start one day, and this remained the solution approach. It pivoted to solving the problem of high cost and long lead time supply chains in the transportation of wine from Italy to California. It ended up being a comprehensive supply chain model after the product left the port of Livorno, Italy. By combining the disciplines of industrial engineering and agriculture business, this project also could be viewed as a Sales and Operations plan for Bucher and Magnuson Inc. Wine Imports.

The following are a bulleted list of high level conclusions:

● Unconcerned with time, the cheapest route for 1 TEU of 56 pallets of wine is to go from the port of Livorno, Italy through Long Beach and trucked up to Paso Robles, California.

● The optimal allocation of wine in our TEU based on a customer demand survey of the target market, San Luis Obispo, are 321 cases of Tegolaia Toscana, 236 cases of Calice Del Conte Toscana, 111 cases of Chianti Rufina, and 228 cases of Gavignano.

● Based on the business plan including the sales and operations report, this is a profitable venture resulting in a net profit of roughly $71,631.56 before taxes.

● By classifying inventory based on pick frequency and implementing a reorganization of the pallets, the storage facility has a new layout for optimal picking processes.

● After being scaled, New York becomes the optimal port for adding to system throughput.

In general the conclusion can be made that this is a lucrative venture. Although there are risks with ports and outdated market data, I am fairly confident that if I had the money for the initial investment this venture is one worth pursuing.

We learned a lot in the completion of this project. Overall, a lot was learned about the supply chain of perishable goods industry. We had never known before that there were so many fees and charges associated with importing goods from foreign countries. Being a multi-disciplinary senior project, It was
also very interesting to work with someone more business minded. The business plan aspect to our project differentiates it from more traditional engineering projects.

A big part of this project where we ran into some problems but made an important conclusion is that in the initial phases of a supply chain design it is often a simple addition problem. One simply adds the costs of each potential chain and finds the cheapest one. In industrial engineering we learn a lot about optimization functions, which we desperately tried to apply to our model. After considering several factors, we found optimization of our supply chain to be impractical and rather focused on optimizing the wine products inside the TEU to fit market demand. Most operations research methods are applied to established companies, when looking to allocate certain inventories through certain distribution centers, which was not the case with our model, nor realistic.

Although overall we would recommend this business venture to someone in the wine import business there are still some reservations. Generally speaking, we would recommend lowering inventory throughput in the supply chain. Utilizing the new shipment tactic of LCL, one could order less inventory at a time in order to meet customer demand. Customer demand is also a very tricky thing to measure and that is where my second recommendation comes in, ERP integration. Right now, the 3 tier system of has many communication barriers. Instead of a supply chain where suppliers, vendors and customers buy and sell from each other, one where everyone in the supply chain communicates would be more effective and thus increase profits. This same concept has been applied to many other industries and profits have grown. If all three tiers of the supply chain were communicating on the same page and had a way to communicate to match customer demand this system would become less inventory heavy, more lean. This would in turn reduce wine desalination, waste and environmental impact.

Environmental Impact

Although right now companies find it profitable to outsource manufacturing and ship products a time will come where fuel prices are so high that it is not profitable anymore. Governments are already starting impose taxes on the shipping industry. As seen in this project, the sulfur fee of $72 per route. In
the coming years, taxes like this will increase along with fuel charges until it is no longer profitable to ship products.

When discussing wine and the alcohol industry overall, there is no question that there is a lot of waste involved. From the bottles, to the corks, to the labels, to the boxes, to the wrap over the wooden pallets, tons of material goes into supplying one customer with one bottle of wine. Most glass bottles, boxes, and wooden pallets can be recycled but labels and wrap are harder to reuse. In the future more energy and effort needs to be focused on the reuse and recycling of wine to make it a sustainable product, because after all, it comes from the earth.

References/Bibliography

References For Literature Review:


Other References:
