FAMU-FSU College of Engineering

BASF Warehouse Management Project

A Report Submitted to:
Dr. Okenwa Okoli

Department of Industrial & Manufacturing Engineering

Prepared by:
Katia De Leon
Felicity Forness
Jorge Tobar

Tallahassee, Florida, USA

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This report is the first of five progress reports. It defines the opportunities and constraints of this project following the Six Sigma methodology of “Define, Measure, Analyze, Improve, Control” (DMAIC). The team’s approach, deliverables the team will provide at the termination of the project, and a detailed description of the customer requirements are provided.

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Abstract

BASF catalyst division Attapulgus, GA is facing major issues with their warehouse management. The goal of the senior design team is to create a new warehouse management system that will provide a more organized and efficient warehouse. In order to do so, the senior design team will develop a new visual management layout of the warehouse, a detailed organization of all stored material, as well as a more controlled process of the overall storage. For the Define Phase report the company provided their critical customer requirements. With those in hand, the team could establish a set of possible solutions that would solve their warehouse problem. This will be accomplished by focusing on analyzing the voice of the customer, which determines what factors are critical to quality.

1. Introduction

BASF (Baden Aniline and Soda Factory) is a German international chemical manufacturing corporation. They have been creating chemicals for over 150 years becoming the world's leading chemical company. Their mission is to "create chemistry for a sustainable future"[1] by incorporating economic success, protection of the environment, and social responsibility. BASF products range from chemicals, plastics, performance and crop protection products, to oils and gases [1]. More than just a chemical company, BASF aims to preserve resources, nutrition, and a high quality of life.

The BASF Corporation in North America is the largest affiliate of BASF SE (European company). They have more than 17,000 employees in North America and sales up to $20.6 billion dollars. BASF has headquarters in states such as New Jersey, Louisiana, and Michigan, with each one in charge of a specific working division. The BASF Corporation headquartered in New Jersey is in charge of the catalysts division. They are the world's leading supplier for environmental and process catalysts [1]. In the United States, the catalyst division has locations in over 12 states. They provide the development and production of fuels that power most of the United State's transportation systems.

The BASF facility located in Attapulgus, Georgia is part of the catalyst division that specializes in the manufacturing and shipping of the catalyst used in the chemical, petrochemical, and refining industries in the United States [1]. The problem that always comes after the production of these batches is the storage. The facilities main warehouse is where they store excess material, packaged material, most of the higher priced material, material that need reprocessed, as well as other items.

However, the space in the warehouse is limited and unorganized. Due to this, the company has to deal with inaccurate inventories that require frequent adjustments. The disorganization is caused from accumulating material that, in the long run, utilizes needed space in the warehouse. The company has tried to work toward a solution to this problem by making gradual improvements but nothing has stuck because resolutions are not sufficient enough to encourage workers to continue their use.

The main goal of this project is to introduce a new layout that is efficient, organized, and that will allow the company to take full advantage of the entire space. Furthermore, to introduce a visual management system that helps the workers know where a material is in the warehouse. Finally, introduce a process for a proper inventory, additive production, and consumption control. The primary goal for each of these steps will be to ensure their sustainability by motiving the workers to use the improvements for better productivity, organization, and efficiency of the warehouse.

This Define Phase report will not only define the project, the problem behind it, and the ultimate goals, but also provide a detailed analysis of each. The team will establish a project charter that will consist of defining the scope of the project and the team behind it. They will collect data and analyze the voice of the customer by determining what they consider to be critical to quality. In addition, they will provide the milestones of the first phase. Furthermore, the team will measure data to analyze and prioritize the alternatives of the problem in hand depending on the preceding phases of the sigma DMAIC methodology.

2. Project Charter

2.1 Project Overview

2.1.1 Objective and Expected Benefits

1. The team will organize the warehouse in a way that eases the locating and transporting processes of the products. The team will create different sections in the warehouse, in which each different group of products will be located. These sections will be quality control products, research and development products, out-of-spec products, ready to ship products, and additives.
2. The team will develop a visual management system, so that each employee entering the warehouse is able to locate products and sections.
3. The team will develop a shortest-path-route for each product depending on the frequency of use and importance.
4. The team will implement a new labeling system that will be both visible and resistant. This labeling system may need to be applied to all the sides of the super sacks in order to make it easier to locate a bag and to improve inventory management.
5. The team will improve the current method of inventory. A barcode or RFID system would be ideal, and could save a lot of time and money at the end-of-month inventories. Preferably the new inventory method would keep the warehouse material updated in real time.
6. The team will find a way to make the changes maintainable. Sustainability is crucial in order for the new process to function properly. We will take into consideration employee's input, as well as design a periodic status update and/or control chart.

2.1.2 Expected Benefits and Business Case

BASF wastes many hours at the end of the month trying to reconcile data from the warehouse. Because the system is unorganized and lacks a proper labeling system, it is difficult to locate products and to have a proper control of inventory. Their current inventory lacks accuracy in both number of super sacks per product and products inside the warehouse. To illustrate the dysfunctional system, the team was given the task to find a single bag of a particular product and there was no success on finding the Super Sack©. The team later found out that the product had been used, but the information was not updated in the inventory sheet.

An efficient warehouse management system would reduce the time spent by employees trying to consolidate data from the warehouse, and it would also improve inventory control. A good inventory control system would result in savings in time and labor. Furthermore, if BASF had a better knowledge of the products in their warehouse, they would be able to reuse materials when producing a new batch of the product and save in individual components used to produce the product.

Likewise, organizing the warehouse with a user-friendly layout would result in several benefits for the company. Employees would know exactly where each product is located and what it is being used for. This would allow anyone from the company to go to the warehouse and find products with ease. This is why a visual management system is required.

To evaluate the expected benefits, the team will analyze the opportunities and threats of this project. These two will be analyzed in a short term period (less than six months) and a long term period (more than six months). For this project, the team will create a threat and opportunities matrix to analyze what could go wrong if the improvements are not successfully completed and what could be gained from implementing the improvements.

	Threats	Opportunities
Short Term	· Sections Will not be Implemented · Extra Manpower · Inaccurate Inventory	· Good Inventory Control · Monthly Time Savings
Long Term	· Higher Levels of Inventory · Not Sustainable	· Reduced Level of Inventory · Sustainable

Table 1: Threats/Opportunities Matrix

There are different kinds of threats that can occur if the team does not reach the goal of improving the warehouse. The short-term threats are similar to the current issues they have inside the warehouse. Inaccurate inventory will continue to be an issue and waste time for employees when retrieving inventory information. Also, they will continue to stack material and place them in the first available space they see, instead of placing them in the corresponding section. The long-term threats will include higher levels of inventory due to employee's continuously bringing in material to be stored and failing to reuse the product when possible. The other long-term threat is that it will not be sustainable over the long run, meaning that any improvement to the warehouse will only be good for a couple of months and then employees will continue to carryout the task as previously performed.

Achieving the goals of the project will also result in some short-term and long-term opportunities. Over the short-term we will save time when looking for a product, because it will

be organized in their corresponding section and employees will have access to a map showing the exact location. Another positive impact that will result in the completion of the goals is that BASF will have an accurate inventory of what is stored in the warehouse and it will be updated in real time. The long-term opportunities include having a low level of inventory, because they will start using the products stored to produce new batches of the same product, instead of producing the same batch of the product from the beginning. Accomplishing the goals will result in making a way for them to be sustainable. If we achieve this, we will have found a way to make the employees more involved in the decisions and they will feel confortable with the changes applied.

2.1.3 Project Stakeholders and Team Organization

The senior design group is composed of industrial & manufacturing engineering students. The team members are Katia De Leon, Felicity Forness, and Jorge Tobar. Each student will have a different role inside the team. For phase 1 (define), Tobar will be the team leader. Team leader will be in charge of keeping the team informed and on track. Forness will be the team Webmaster and scribe. The team scribe is responsible for keeping the meeting minutes updated on the blackboard blog. De Leon is the secretary, who is in charge formal communications with sponsors and stakeholders. Each team member will be assigned a different role for each new phase.

The project sponsor is BASF, and their stakeholders for our project are Regina Molisse, the Quality and Continuous Improvement Manager, and Brian Telesz, the Supply Chain Planner. Mr. Telesz is responsible for setting meeting dates and times and is also the main communication agent. For the college of engineering we have several stakeholders. Dr. Okenwa Okoli, the

Senior Design class professor and Head of the IME department, Dr. Tarik Dickens, Dr. Hui Wang, Margaret Scheiner, and Geoffrey Ryan Adams.

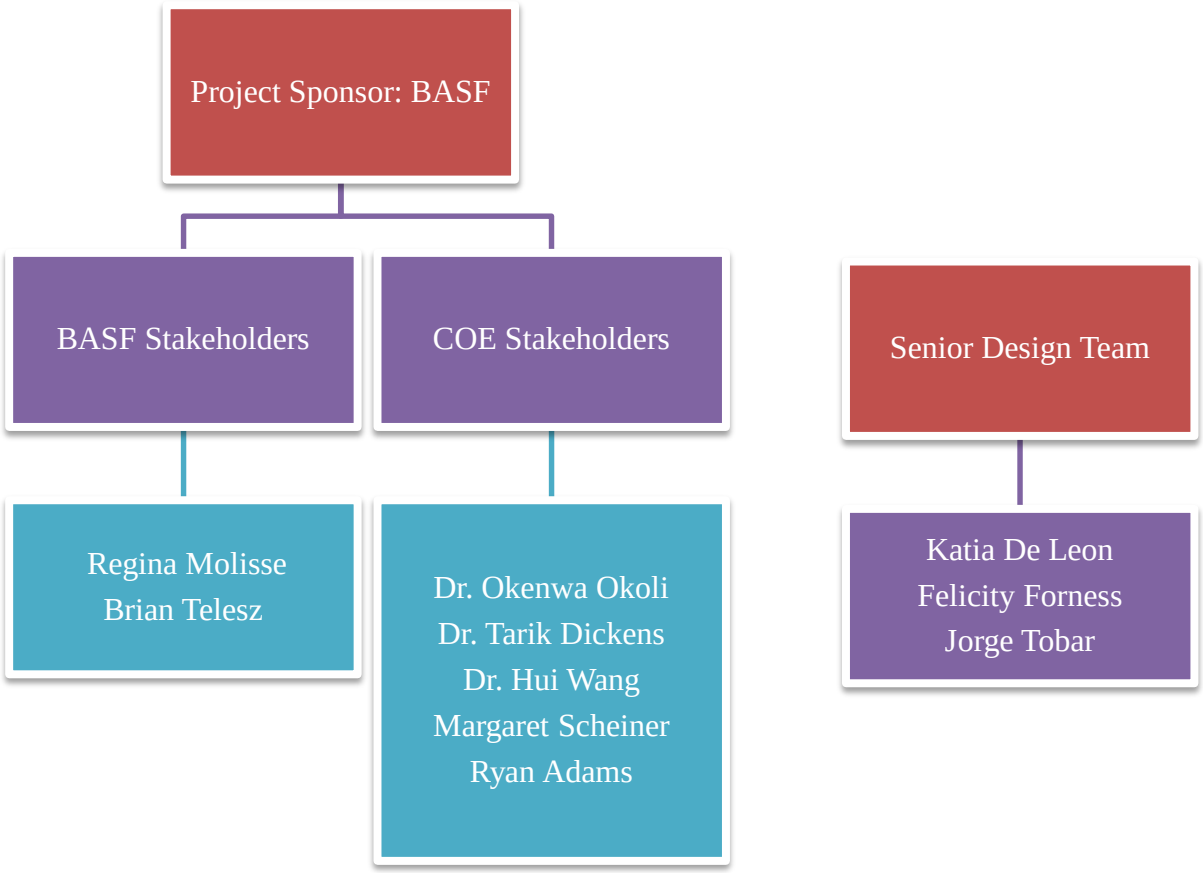


Figure 1: Project Stakeholders and Team Members

2.2 Approach

2.2.1 Scope

The team will evaluate the current situation inside the warehouse, find the proper solutions to improve the current layout, and find a way to make it sustainable. We will determine a set of solutions that improve the organization to make it more accesible to employees. We will also implement a visual management system that will help employees find products quickly and

without problems. The ultimate goal is to make all the implementations sustainable. Employees should be involved in the decisions and must be pleased with all the changes made. All of the changes to be made must be within the exisiting warehouse. Building a new warehouse is out of scope for this project.

2.2.2 Assumptions and Constraints

Some of the assumptions the group is considering are as follows:

1. The use of a forklift is necessary for all product movements inside or outside of the warehouse.
2. Implementing a color system to determine sections will help organize the products and use them in a first-in-first-out system.
3. When a product is placed inside the warehouse, it should be placed behind chemicals of the same batch.
4. Developing a shortest path for retireving each product will reduce transportation time.
5. If a barcode or RFID system is implemented, labeling should be placed on all four sides of the super sack.

The constraints within our project are as follows:

1. All material needing to be stored must be stored in this warehouse.
2. All manpower and funding is internal.
3. A new warehouse is not plausible.
4. The implementation of shelves is not possible within our time frame.
5. External lables should have the adhesive capability to stick to Super Sacks©.
6. Final solution should align with suggestions from warehouse employees.

2.2.3 Deliverables

During all of the phases of this project, the team is responsible for compleating reports, powerpoint presentations, posters, and sending them to BASF sponsors as well as submitting them to the teaching assistants, and uploading them to blackboard. For the define phase the deliverables and their due dates are:

Deliverables	Due Dates	Recipient	Team Leader
Team Contract	September 17, 2015	Teaching Assistants	Jorge Tobar
Phase 1 – Define Report	October 16, 2015	BASF Stakeholders	Jorge Tobar
Phase 1 – Define Report	October 20, 2015	Teaching Assistants	Jorge Tobar
Phase 1 – Define Presentation	October 20, 2015	Teaching Assistants	Jorge Tobar

Table 2: Phase 1 Deliverables

The team also developed a SIPOC Diagram, which stands for suppliers, inputs, process, outputs and customers. The process column in this diagram identifies what the team is trying to achieve with this project. Our suppliers are our project sponsor, BASF, and the College of Engineering stakeholders. BASF is supplying the resourcers we need to complete the project. So far we have recevied the current inventory, the warehouse layout, and we have scheduled inteviews with warehouse staff. W have also requested the distance from the warehouse to shipping. The outputs represent the steps the team will take to achive the goal of the project. The

team will develop optimal organization inside the warehouse, implement a better inventory system, a visual management tool, a shortest path route, a new labeling system, and ultimately make the changes sustainable. The customers for this project is BASF and their warehouse.

S	I	P	O	C
Suppliers	**Inputs**	**Process**	**Outputs**	**Customers**
BASF COE Stakeholders	Current Inventory Employees Interviews Warehouse Layout Distance to Shipping	Warehouse Management	Optimal Organization Barcode Inventory Visual Management Shortest Path Labeling System Sustainability	BASF Warehouse

Table 3: Suppliers-Inputs-Process-Outputs-Customers Diagram

3. Defining Customer & Technical Requirements

The BASF Company has proposed to solve an organizational problem that they are facing with their main warehouse. The process consists of the organization of one-ton bags as they enter the warehouse and how to manage and export the items once stored in the warehouse (ure 2). The process begins as products are initially brought into the warehouse. The current process does not require any particular product to be placed in a specific location in the warehouse but rather to be placed wherever it will fit. This has caused pure pandemonium when trying to locate an individual product in order to retrieve it for use. The one-ton sacks contain

only a single label, which causes major identification problems if the label fails to face outward. The indistinguishable labeling system causes the warehouse to often have an inaccurate list of inventory and virtually no means to find a particular product. If a product is clearly identified and found it can be exported from the warehouse, however the warehouse also lacks the proper mapping to visually direct the forklift operator on how to best retrieve the item. The features that BASF sponsors have emphasized to improve upon are to develop a new warehouse layout, create a new labeling system, design shortest path map for each product, and implement a system for exporting products.

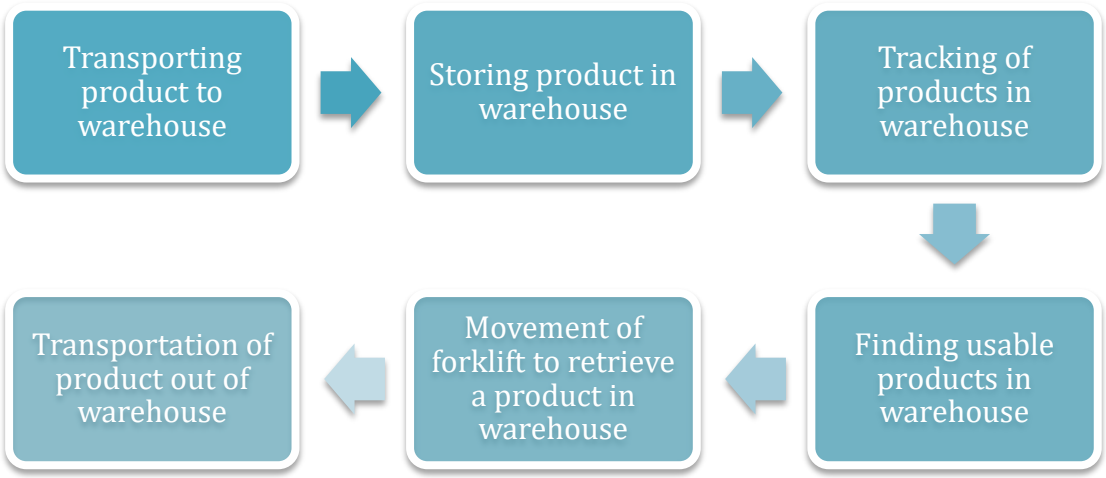


Figure 2: Process Flow of Warehouse

The initial and primary goal is to develop a new warehouse layout in order to best maximize the use of space and minimize the travel time needed to retrieve products. All subsequent improvement features will be based on the new warehouse layout and therefore this task must be completed first. Currently the warehouse contains products that are waiting to be exported, extra remnants of products produced in excess, Research and Development samples, and products that need to be retested. The goal is to arrange the products into sections of the warehouse based on these categories. Furthermore, products will need to be organized in a way

that the most frequently used products are accessible for easy retrieval. As in all designs, the new layout that is produced will determine the functionality of all later steps of the customer requirements.

Depending upon the new warehouse layout that is developed, the next requirement that will need to be fulfilled would be to determine a new efficient labeling system. The current labeling on the products in the warehouse consists of a sheet of paper placed inside a clear protective plastic that is attached to one side of the one-ton sacks. The flaw in this labeling system lies primarily in the placement of the sacks. Sacks are often placed in the warehouse with its label facing another one-ton sack, which makes identifying the product nearly impossible without the use of a forklift. The new layout will determine whether the one-ton sacks need to be identifiable from all sides or just particular sides. Once it is determined how many sides the product will need to be viewed by, the team must design a way to carryout the actual labels. The labels have to be quick and easy to attach to each bag, but also must be able to stand the test of time. Many products in the warehouse have been there for many years and the current paper labels have faded ink, as well as obvious wear and tear that make many of them illegible. The new labeling system should be both simplistic and easily identifiable.

When each product has it’s new assigned location it is crucial to clearly identify the shortest path for retrieval in order to maximize the functionality of the new layout. The warehouse currently lacks any mapping system for the location of a product and gives no indication as to the process on how to best retrieve the item. The team will produce a map of the facility that visually displays the section of the warehouse where a particular product is located and the shortest path in which to retrieve the item. The map not only has to be easily readable but also has to be easy to edit so that it can change as the warehouse inventory changes. Consistent

with the map, there needs to be swim lanes implemented to help guide the forklift operator once in route to a specific product to ensure optimal efficiency in the retrieval process.

Concurrent with the design of the shortest path there is also the need for an internal system to assist in exporting products from the warehouse. Aside from products that are specifically placed into the warehouse to await export from the plant, there is very little knowledge of what materials can be exported from the warehouse. Without some form of internal database that clearly defines the state of each product in relation to its ability to be exported it is nearly impossible for a product to be removed form the warehouse. The ambiguity of the state of each product and the lack of knowledge on how to retrieve said product is a major contributor to the growing inventory in the warehouse. By creating a database for all products in the warehouse it will help to ensure that products that can be used are being used in the most efficient way possible.

The team developed a cause and effect diagram or fishbone diagram to analyze the major causes of the problem inside the warehouse. Those problems could be human resources, equipment, management, and methods. Human resources problems may be due to a lack of a define process for their current warehouse management and the employees hired may not be aware of their wrong doings. The equipment in the warehouse may also be a cause of this problem. The Super Sack© material is nylon, which makes it difficult to place any form of identification. The current labeling system is not efficient and they usually place identification to only one side of the Super Sack. At the management level there is no one responsible for keeping the warehouse organized and the need to hire any permanent warehouse staff is likely insufficient. Also, their current method of inventory is manual and makes it inaccurate. They

lack proper organization of where the materials are placed inside the warehouse and they have no proper signage of where each material is located.

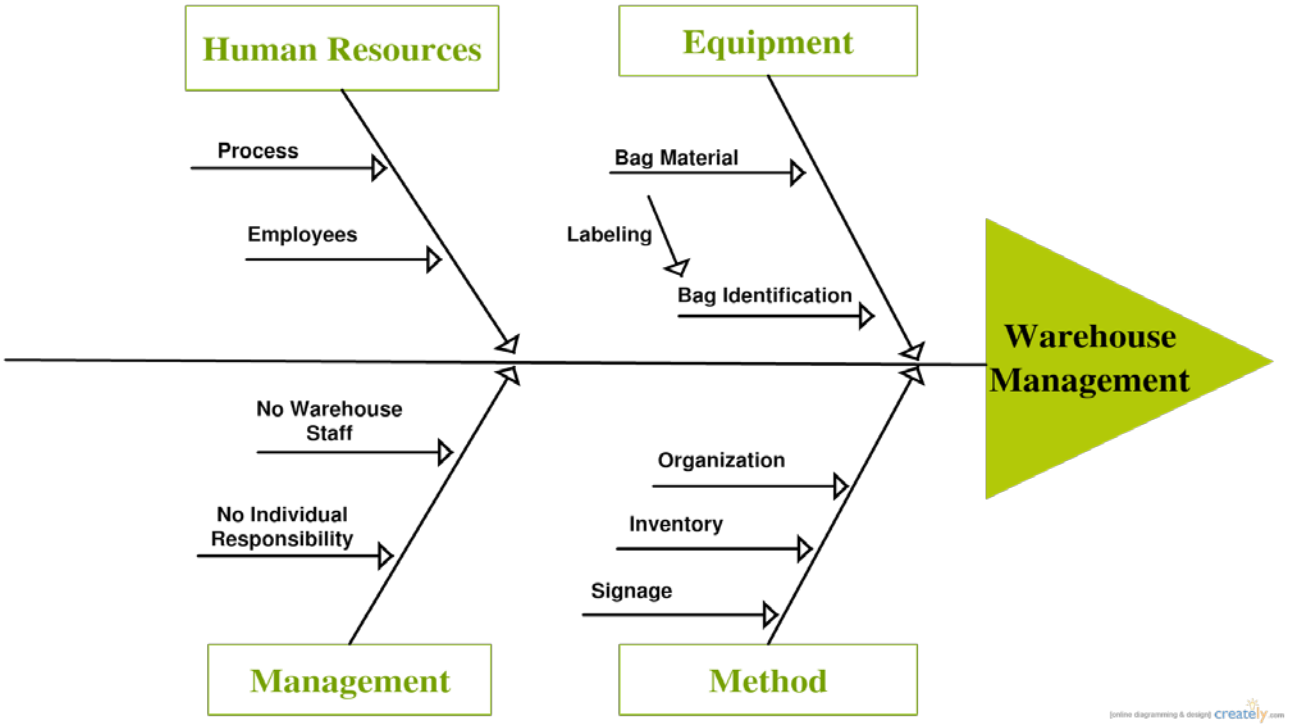


Figure 3: Fishbone Diagram

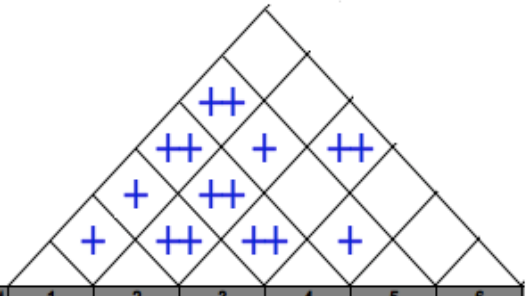
The team also developed a house of quality matrix (HOQ) to determine the importance of the task to be implement to the warehouse (see Figure 4). The HOQ is divided into the customer requirements (what the customer wants) and the functional requirements (how to achieve what they want). These two requirements are then related to each other in a relationship matrix. For this project, the team defined the customer requirements as organizational layout, visual management, sustainability, and inventory control. To be able to accomplish these, the team established the functional requirements to be implementing swim lanes for the forklift to move around the warehouse freely,

creating a map of the warehouse, improving their current labeling system, implementing sections, developing a shortest path, and the implementation of controls and processes.

Each customer requirement has a relationship with each functional requirement. For example, visual management had a strong relationship with the mapping, labeling, and the implementation of sections, because the development of a map of the warehouse would help eliminate any waste of time when retrieving a product from the warehouse. The labeling system would help differentiate different products and different sections. These reasons are vital for the visual management system of the warehouse. Visual management has moderate relationship with control and processes, and a low relationship with swim lanes and shortest path. They do not have a strong relationship because they do not affect how the visual management is to be implemented in any major ways.

Another aspect of the HOQ is the correlation of the functional requirements. These could have a strong positive correlation, a positive correlation, a negative correlation, or a strong negative correlation. For example, swim lanes has a positive correlation with mapping and labeling system. It has a strong positive correlation with sections and shortest path. The positive correlations are due to the fact that implementation of the mapping and the new labeling system does not affect the creation of swim lanes. The strong positive correlations are due to the fact that the creation of swim lanes is dependent on the different sections of the product, which need to be achieved correctly depending on their frequency of use and their importance. All of this must be done while also considering the shortest path.

Legend		
Θ	Strong Relationship	9
O	Moderate Relationship	3
▲	Weak Relationship	1
++	Strong Positive Correlation	
+	Positive Correlation	
—	Negative Correlation	
▼	Strong Negative Correlation	
▼	Objective Is To Minimize	
▲	Objective Is To Maximize	
X	Objective Is To Hit Target	



Row #	Max Relationship Value in Row	Relative Weight	Weight / Importance	Demanded Quality (a.k.a. "Customer Requirements" or "Whats") / Quality Characteristics (a.k.a. "Functional Requirements" or "Hows")	1 Swim Lanes	2 Mapping	3 Labeling System	4 Sections	5 Shortest Path	6 Controls and Processes
				Direction of Improvement: Minimize (▼), Maximize (▲), or Target (x)	▲	X	▲	X	▲	X
1	9	26.3	5.0	Visual Management	▲	Θ	Θ	Θ	▲	O
2	9	26.3	5.0	Organization Layout	▲	O	Θ	Θ	Θ	O
3	9	26.3	5.0	Sustainability		O	Θ	O	O	Θ
4	9	21.1	4.0	Inventory Control		O	O	Θ		Θ
				Target or Limit Value						
				Difficulty (0=Easy to Accomplish, 10=Extremely Difficult)						
				Max Relationship Value in Column	1	9	9	9	9	9
				Weight / Importance	52.6	457.9	773.7	742.1	342.1	584.2
				Relative Weight	1.8	15.5	26.2	25.1	11.6	19.8

Figure 4: House of Quality

The team developed a deliverable-based work breakdown structure (WBS) to help define what needs to be accomplished throughout the project (see Figure 5). During the research and design phase the team met with the project sponsors and toured the warehouse in order to develop a clear and concise scope. In order to have sufficient data to design the proper warehouse management system the team will also interview the warehouse staff, make a spaghetti diagram mapping the current system, and take an accurate inventory on the products in the warehouse.

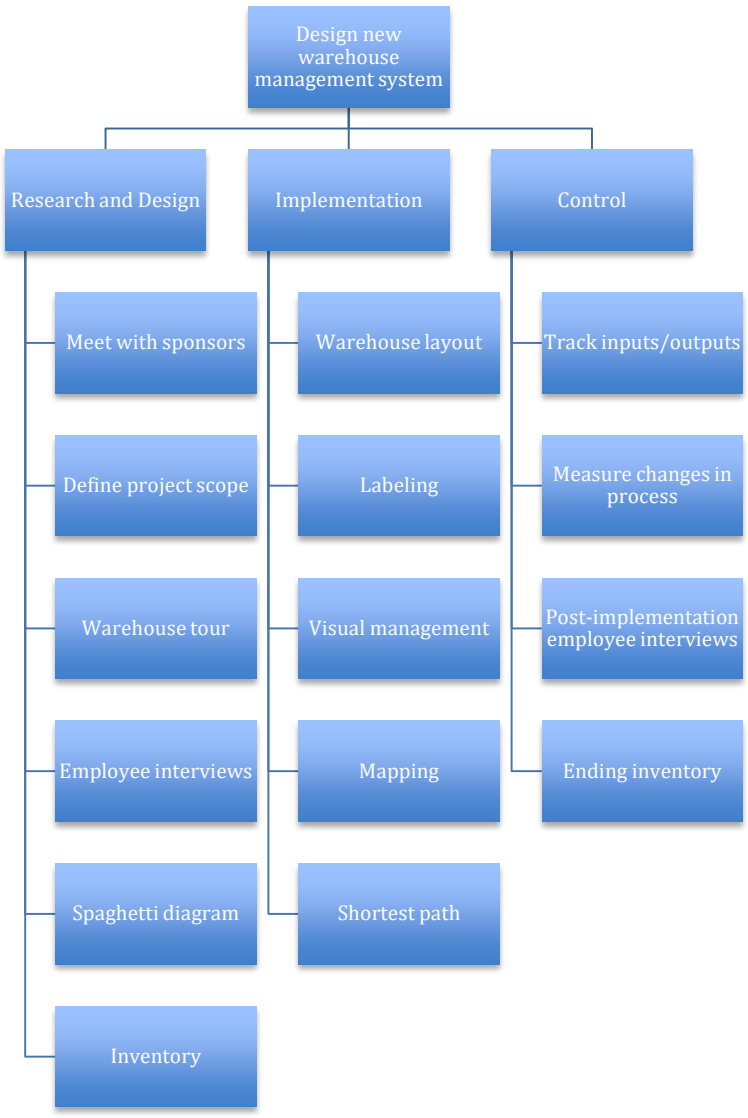


Figure 5: Deliverable-based Work Breakdown Structure

The implementation deliverables are currently made up of the customer requirements, but this is subject to change as the project progresses. In the control phase we hope to quantify both the inventory and the inputs/outputs of the warehouse in order to show system improvements. To ensure the new process is sustainable, the team will conduct post-implementation interviews with the warehouse staff. To assist the WBS the team developed a responsibility assignment matrix (see Table 4). This matrix has each task and the role of each person in relation to that particular task. If the person has the letter R it means they are responsible for that task, which means they are doing the work. If the letter A is assigned it means the person is accountable for the task, meaning they are expected to justify the actions. If the person is assigned a C it means they are consulted about the task and if they are assigned and if assigned I it means they are simply informed about the task.

WBS Element	Project Team Members			COE Stakeholders					BASF Stakeholders	
	K. De Leon	F. Forness	J. Tobar	O. Okoli	T. Dickens	H. Wang	M. Schiener	R. Adams	B. Telesz	R. Molisse
Meet with sponsors	R	A	A	I	A	A	C	C	A	A
Define project scope	A	A	R	I	C	C	I	I	C	C
Warehouse tour	R/A	R/A	R/A	I	I	I	I	I	R/A	I
Employee interviews	A	R	A	I	I	I	I	I	C	I
Spaghetti diagram	A	R	A	I	I	I	I	I	C	C
Inventory	R/A	R/A	R/A	I	I	I	I	I	C	I
Warehouse layout	R/A	R/A	R/A	I	C	C	I	I	C	C
Labeling	R/A	R/A	R/A	I	C	C	I	I	C	C
Visual management	R/A	R/A	R/A	I	C	C	I	I	C	C
Mapping	R/A	R/A	R/A	I	C	C	I	I	C	C
Shortest path	R/A	R/A	R/A	I	I	I	I	I	C	C
Track inputs/outputs	R	A	A	I	I	I	I	I	C	I
Measure change in process	A	A	R	I	I	I	I	I	C	I
Post-implementation interviews	A	R	A	I	I	I	I	I	C	I
Ending Inventory	R	A	A	I	I	I	I	I	C	I

Table 4: Responsibility Assignment Matrix

4. Business Analysis

4.1 Economic Analysis

The current warehouse design clearly lacks organization, however it is difficult to determine the quantity that this disorganization is causing because their products differ from most other products stored in warehouses. The catalysts that are produced by BASF have virtually infinite shelf life; therefore their inability to use the products in the warehouse efficiently does not actually add any additional cost to production. Nonetheless, looking at the use of the space within the warehouse shows how improvement could save money indirectly. BASF is currently under utilizing the space in the warehouse, which stems from a lack of warehouse management. Although movement of products in and out of the warehouse happens infrequently, it is still clear that the number of products being brought into the warehouse exceed the number of products being exported. In the long term, providing a more efficient way to store and export products in the warehouse could prevent the possibility of having to lease extra storage space off-site.

The costs that will be associated with the improvement of the warehouse primarily will consist of paying employees for the rearrangement of the warehouse. The rearrangement will be carried out through internal employees so it may involve having to pay hourly workers overtime to accomplish the task over a weekend. The painting of the swim lanes in the warehouse would be contracted out and the cost of paint would most likely be included in the payment to the contractor. Furthermore, the new labeling system could range from the cost of stencils and paint to a new barcoding or RFID system, depending upon the design we see best fit. All of these costs are crucial to the project because none of the tasks individually will make a great impact.

However, with the new layout, labeling system, and mapping system there will be significant improvements to the organization and export process of the warehouse.

4.2 Environmental Analysis

The environmental impact from the rearrangement of the warehouse may seem negligible but it does have some effect on the environment no matter how minute. By designing the warehouse layout to minimize the amount of travel time required to retrieve a product the team will be lowering the amount of diesel fuel needed for the forklift. This in turn would reduce the amount of emissions produced by the forklifts. Although it is out the realm of this project, BASF could look into the reduction of emissions from their processes from the use of already blended materials stored in the warehouse. Although disposal of the catalyst could contribute to landfills, it is extremely rare for a catalyst to become so contaminated that it no longer has any use. For these reasons the redesigning of the warehouse will have extremely small but positive impacts on the environment.

4.3 Ethical Considerations

At BASF there are very few employees whose job requires them to enter the warehouse regularly. For this reason it is crucial to understand the wants and needs of these employees especially because their disagreement with how something is designed could cause them to completely neglect it and the process would fail. In order to ensure that the employees who will be working most in the warehouse agree with the solutions, the basis of the research done in the measure phase will be drawn from their comments and concerns via personal interviews. The ideal outcome of this project is to increase the use of materials from the warehouse because it is currently easier for an employee to begin a new blend than to pull a product from the warehouse. This means that we have to design a solution that would actually make the employee's life easier

if they were to pull a material from the warehouse in order to motivate them to carry out the process. If a process is designed that is more efficient and makes employee's jobs easier it will be more likely to be carried out continuously. One of the key factors of this project is to provide a sustainable solution and ensuring all parties involved, management and employees, are in support of the final design can accomplish this.

4.4 Health and Safety

For this project, the team considers that there are few to nonexisting health and safety issues. Manual labor inside the warehouse is nonexisting and the only problem that could occur is something related to the amount of time an operator will use a forklift for lifting and transporting the super sacks. Problems could be related to posture or sitting for too long, which is unlikely for the operations inside the warehouse.

4.5 Social and Political Considerations

Applying the solutions to the warehouse will result in better communications between production and warehouse staff, because the production department will be more interested in keeping track of the products stored. Knowing the type of products in the warehouse will result in the use of these blends to produce new batches of the same product. Also, the team will interwiew warehouse staff to know their opinion on the solutions proposed and take into consideration any feedback they might have about improving the warehouse management.

4.6 Sustainability

For this project to be succesful in the long term, we need to make it sustainable. Sustainabilty is the main concern for this project's success. BASF has tried to improve their warehouse management and they have not found a way to make changes stick. As mentioned

before, the team will consider the feedback from the warehouse staff and try to implement their ideas to the project. Also, the implementation of controls to enforce changes will be used. Another importat attribute that must occur to achieve sustainability is constant communication between management and staff after the initial implementation. If the project reaches the goals, BASF will have lower levels of inventory inside the warehouse, because most of the products will be use to produce new batches.

5. Project Progress

5.1 Milestones and Schedule

The level of organization for any project is one of the key components towards its success. Throughout the define phase the team made a schedule based on the availability of each member and stakeholder with the goal of working towards a detailed analysis of the project at hand. At the beginning, the team had the introduction of the project, then had the chance of meeting with the sponsor. After a couple of meetings the team defined the scope of the project. Finally, they could start analyzing the issues as well as brainstorming their solutions. The team created a network diagram (see Figure 6). This provides a better understanding of the overall milestones of the current phase. The following section provides detailed description of the tasks.

When the project was first introduced the team only received information on the company that was going to sponsor them. Knowing this, the team decided to research about BASF, which helped them determine the key goals of the company. However, the problem in hand was not received until three weeks later. Once the team had a more broad idea of what they were going to be working on, they contacted BASF to begin the project. This process was delayed because the sponsor rescheduled several potential meeting dates. After a week the team could meet with the sponsor to define the scope of the project.

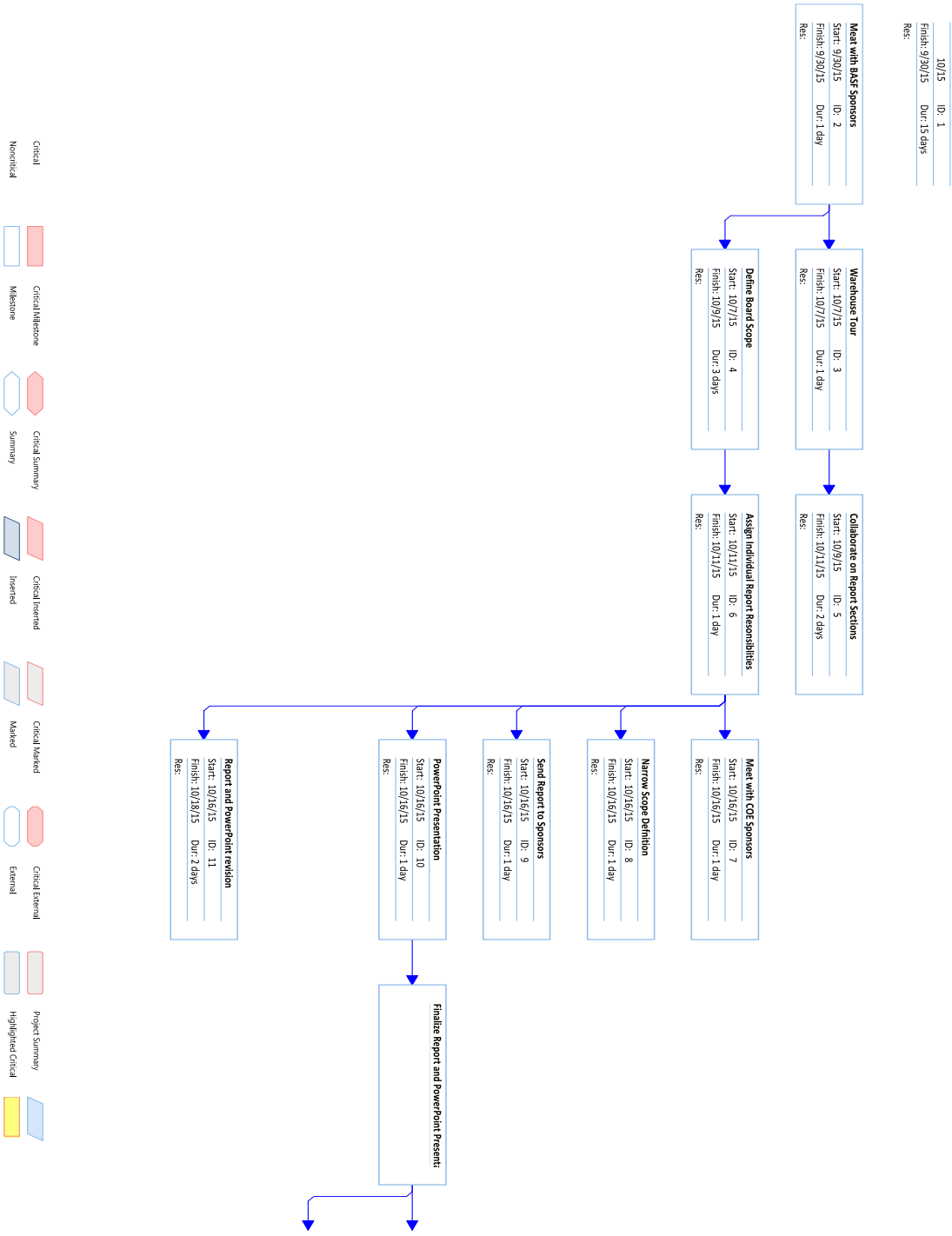


Figure 6: Phase 1 Network Diagram

The first meeting, the team and sponsor were able to set a day/time for weekly meetings. This helped the team develop better organization and communication with the sponsor because they could work on the scope and the deliverables of the project. The team could also come up with questions and have feedback by the following week, which provided them a good flow of information and personal work. However, at this stage the team still had a vague idea of the warehouse.

On the second meeting with the sponsor the team had the opportunity to have a tour of the warehouse. This was one huge step because it helped the team have a better look and understanding of the problem at hand. With this the team realized that the company had a lack of organization and space in the warehouse for the amount of material they accumulate. This also helped them understand the constraints the company has with the warehouse, as well as helped them brainstorm ideas and potential solution alternatives. After the tour the team was able to start implementing a plan for the Define Phase.

Moreover, the team had a Q&A meeting with one of the main stakeholders. This meeting was crucial because it helped the team establish the customer requirements, which constitute in the development of the House of Quality (HOQ). It also provided the team a clearer economic analysis, as well as set a tentative budget relative to the provided alternatives for the management of the warehouse. During that same week the team had a meeting with new stakeholders, Ph.D. professors of the COE. This meeting was significant to the team because it presented new ways of addressing the problem in hand.

After the first three meetings with the sponsor and all stakeholders the team was able to finish in detail the Define Phase report and presentation with a more narrow scope and action plan towards the warehouse. For a more detailed view of the schedule for this current phase the

team created a Gantt Chart (see Figure 7). Gantt Charts show production over a certain period of time. This tool showed the critical path during this phase, with all tasks completed on time. The breakdown shown in the Gantt Chat provided a good schedule that allow the team to have time for final revisions of the report and practice the presentation.

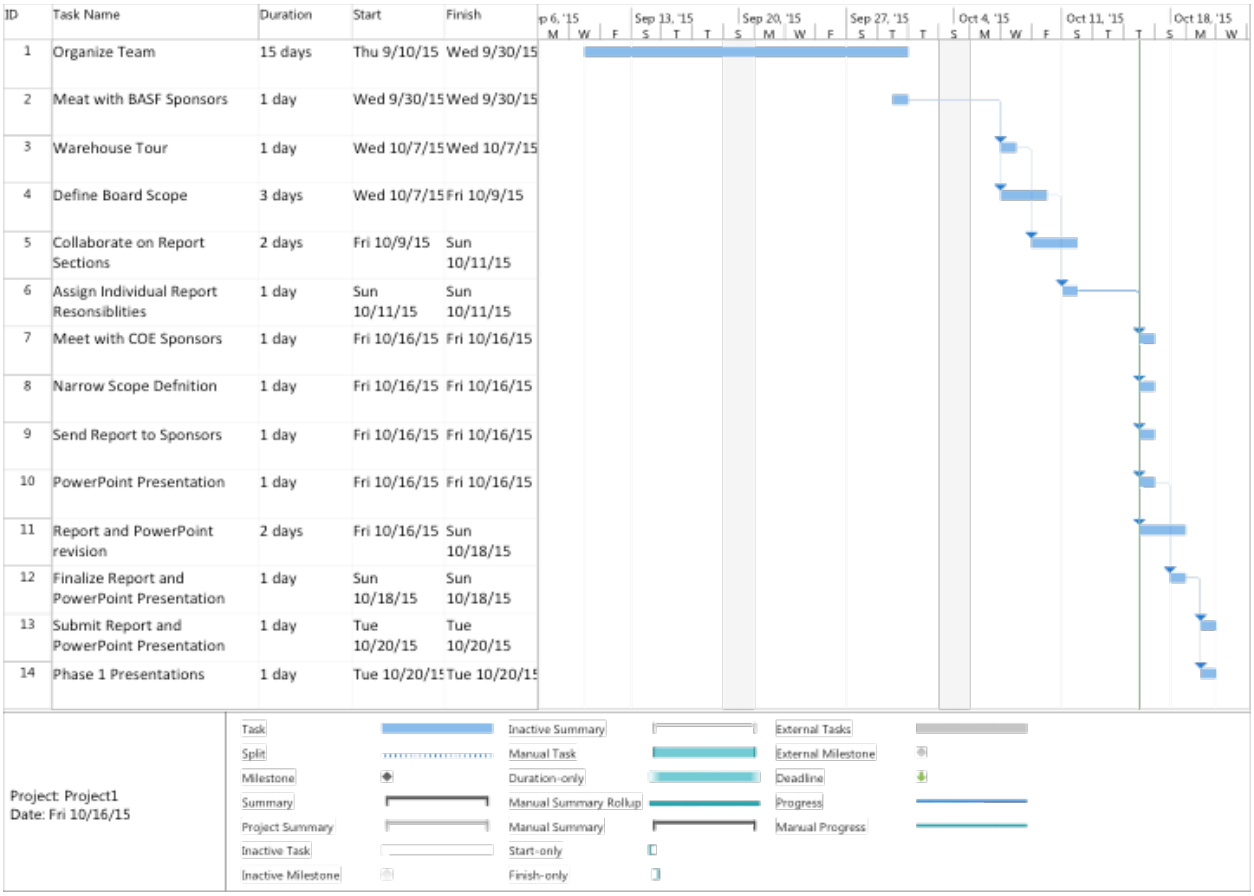


Figure 7: Phase 1 Gantt Chart

5.2 Risk Management

The creation of a new warehouse layout has positive and negative risks that the team should address and understand in order to know if it is worth it to implement the previously mention possible solutions. In order to have a more in depth analysis of these risks, the team developed a SWOT matrix (see Figure 8). This matrix not only compares the strengths and the

weaknesses of the overall goal, but also differentiates the risks that could possibly appear in the process. The opportunities are the positive risks and the threats are the negative risks. This gives the team an insight of what they might encounter during the application of the primary and secondary needs showed in the VOC tree (see Figure 10). This analysis also prepares the team on what to do if something goes wrong during the process.

Figure 8: SWOT Matrix

Positive risks are the opportunities that come out from a good process. These sustain the solutions provided towards a given problem and give value to the project. For BASF the positive risks of implementing a new warehouse management layout relapses in a more optimal efficiency of the warehouse. This risk has a high impact level since it will promote workers to keep a better, well-organized working environment. In order to achieve this, the team is working towards a detailed visual management layout that will show an ideal warehouse. However, the

probability of this risk becoming an opportunity is still low since, until now, there has not been any formal implementation of improvements strong enough to achieve this goal.

An efficient warehouse implies having a better organization of the overall material. This is also considered an opportunity towards the implementation of the new layout. This risk also has a high impact level because it promotes efficiency, which is the key component regarding the goal of this project. BASF's main concern is to implement a new layout with optimal organization. Due to this, they have asked for an efficient labeling system for the material and the shortest path for a better working flow. This risk has a high probability of happening because, throughout this phase, the team gathered relevant information that will assist towards the creation of a more systemized warehouse.

The SWOT matrix also shows that an ideal, well-organized warehouse provides a low level of inventory, which in turn saves time and money when it comes to the organization and production of the material. These are risks that any company should like to take because they will mean that the company is not losing any money. These risks will have a medium impact level because, at the time, BASF knows they are not loosing any money for having material in storage. However, they know they are not using the space in the warehouse wisely. This happens because they do not have a good control of what materials are stored in the warehouse, so the worker wastes time in looking for the materials needed for a given blend. These risks will also have a high probability of happening if the company starts implementing a more controlled process of what goes in and out of the warehouse.

Negative risks can also be part of the process. It is important to know why threats appear and how to treat them in order to avoid a negative impact on the project. The SWOT matrix shows that one of the main threats in failing to achieve a better warehouse management layout is

stacking. This risk has a high impact level because BASF has more than one hundred Super Sacks© with tons of material stored in their warehouse. Every time they finish production they keep loading the warehouse by putting the material in pallets and piling them up. This also causes the Super Sacks© to deteriorate, eventually tear and start dropping material out of the sack. There is a high probability that this threat keeps occurring since the company is not taking care of their material. If this company starts implementing a well-organized management process they could economize the overall production process instead of just getting new material every time they have to manufacture a blend.

Piling up material creates inaccuracy in the inventory, which is another threat of having a poor management system. Workers do not have a clear knowledge of what they have in the warehouse and it might take hours to find just one sack of a certain material. There might be times when they are trying to look for a specific sack of material just to figure out that blend no longer exists. This threat causes a high impact because it makes the workers waste time whenever they have to go look for something in the warehouse. This also happens when they are performing the inventory for the material in the warehouse. If BASF does not starts implementing an efficient labeling system there is a high probability that this will keep threatening the personnel efficiency and organization of the warehouse.

Sustainability is the key towards the implementation of a new management layout. However, there has been no idea good enough that makes the company and its workers stick to it. This is a factor that keeps threatening the company and causes a high impact on them, since they still keep seeking for solutions towards the management of their warehouse. They know they are not using that storage in the right way, and they know all the factors that keep affecting

the storage in a negative way. These risks, specially the lack of sustainability, have a low probability of continuing to happen if the team takes action in order to solve the problem at hand.

BASF not only wants the team to establish a new layout, but also implement it and be physically present during the process. In spite of that, there are time constraints that might not allow this to happen. The probability of this happening is low because the time provided for the completion of this project is significantly short in comparison to the amount of time it will take the workers to organize the new warehouse layout. In addition, this risk has a very low impact level on the overall accomplishment of this project because the most important goal is the foundation of the management system.

The identification of all these positive and negative risks helped the team gain a better understanding of the opportunities they will have if they get to fulfill the desired goal. This analysis also helped them be prepare for the threats they might possibly face along the way. Threats of utmost importance should be analyzed more in depth, because if the team does not know or is not prepared to manage and eliminate those risks once they are out then they will negatively affect the completion of the project. One way of analyzing these threats is by the creation of a risk matrix. Risk matrixes assist in comparing the levels strength of each threat. This technique provides a more detailed visibility of the risks, which in turn assists in better decision-making if faced with any of them.

The team created a risk matrix, (see Figure 9) to compare the threats that could be faced during the process of creating a new warehouse management layout. The matrix consists of all the threats previously described and mentioned in the SWOT matrix. This also includes other negative risks such as the extra manpower that will be needed for inventory if the workers keep inventory stored how it is currently. The main goal of this matrix is to show the correlation of

these negative risks relative to their probability and their impact level if they were to happen in the warehouse.

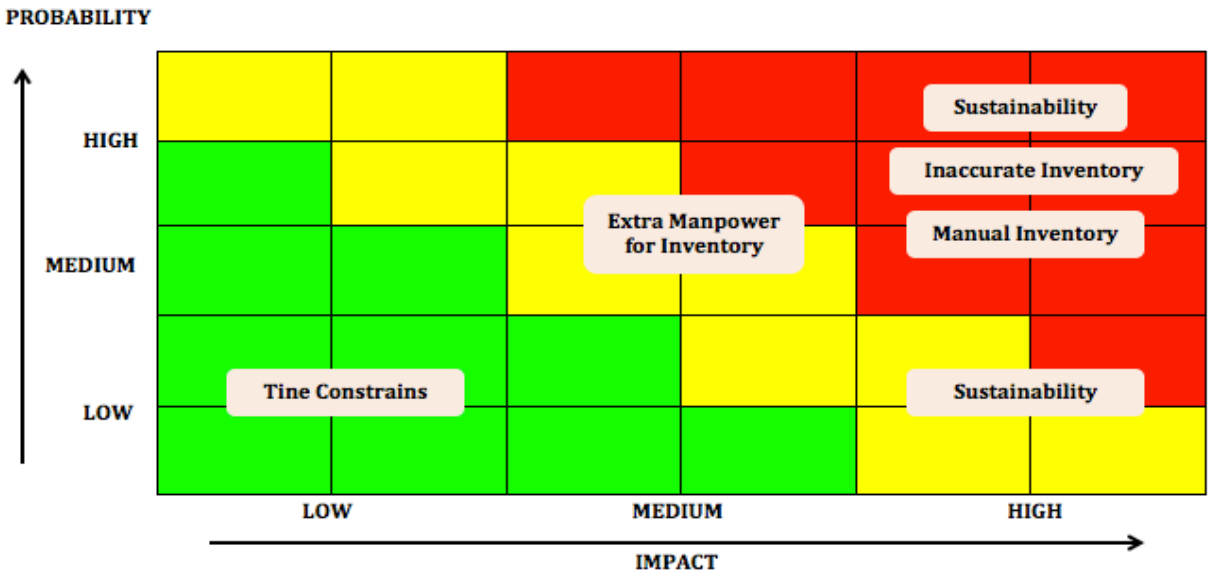


Figure 9: Risk Matrix

The matrix provides the risk levels for each threat by a color index. The higher the threat the higher its probability and impact level, which means it is of great concern for the company. Threats such as stacking, inaccurate inventory, and manual inventory are all related and are of high concern for BASF. Moreover, if more material is stored in the warehouse more workers will have to participate in the monthly inventory, which is categorized as of medium concern for the company. All of these directly affect the efficiency of the workers and the warehouse, as well as the probability of establishing a sustainable new layout. Another threat is the time constraint, which is of low concern for the company; meaning, it will not stop the overall project progress. If the team is not prepared for any of these threats, the company could come to face even higher risks.

5.3 Budget/Bill of Materials

The planning process for the development of a new warehouse management layout takes time and eventually money. At this time, BASF has not provided an estimated budget or BOM for this project. However, after studying the requirements shown in the VOC. The team came to the conclusion that the implementation of the new layout will consist of utensils costs and manpower costs. Utensils costs are to be divided in labeling and visual management. The labeling system can either be done manually or by software. Manually will mean implementing stencils, which require paint; software will mean applying barcodes or RFID. It is important to note that a barcode system requires special barcode sticker labels, the printer for the barcodes, and the scanner. Moreover, the visual management layout consists of applying swift lanes, signals, and maps which also require paint.

The manpower costs or salary will be based on the amount of hours and days workers put into the arrangement of the warehouse. Other costs that could be considered are the license for the forklifts the workers will use to transport material while organizing the warehouse. It is important to note that these are subject to change regarding the status of the project.

Summary/Conclusion

The goal of the warehouse management project is to establish a new layout that will provide BASF with a better, more organized, and efficient warehouse. At the present time, the company has no organization whatsoever in their warehouse. After manufacturability is done the material that does not conforms to their standards is moved to this warehouse. In the long term,

having an increase in inventory in the warehouse makes it difficult for workers to find the material, which leads to inaccuracy in their inventory. BASF knows that they could have better usage of their storage. However, there has been no solution strong enough to motivate a change in the warehouse.

The Define Phase helped the team understand, as well as establish the scope of this project. The team also defined the customer and technical requirements that could help set possible alternatives for this problem. Furthermore, the team provided a business analysis that gives a more in depth analysis of the project, as well as the milestones of this first phase.

The implementation of measuring techniques such as the House of Quality and SWOT matrix were key towards the analysis of the alternatives. Using these techniques serve as a way to prioritize the solutions to be implemented. After finalizing the Define Phase, the team will go on to interview warehouse employees to receive their feedback and the team will determine the key metric to be measured for the Measure Phase.

References

1. *BASF*. Ed. Stefan Glut. BASF Business Services GmbH, n.d. Web. 9 Oct. 2015.

Appendix A

Voice of Customer (VOC)

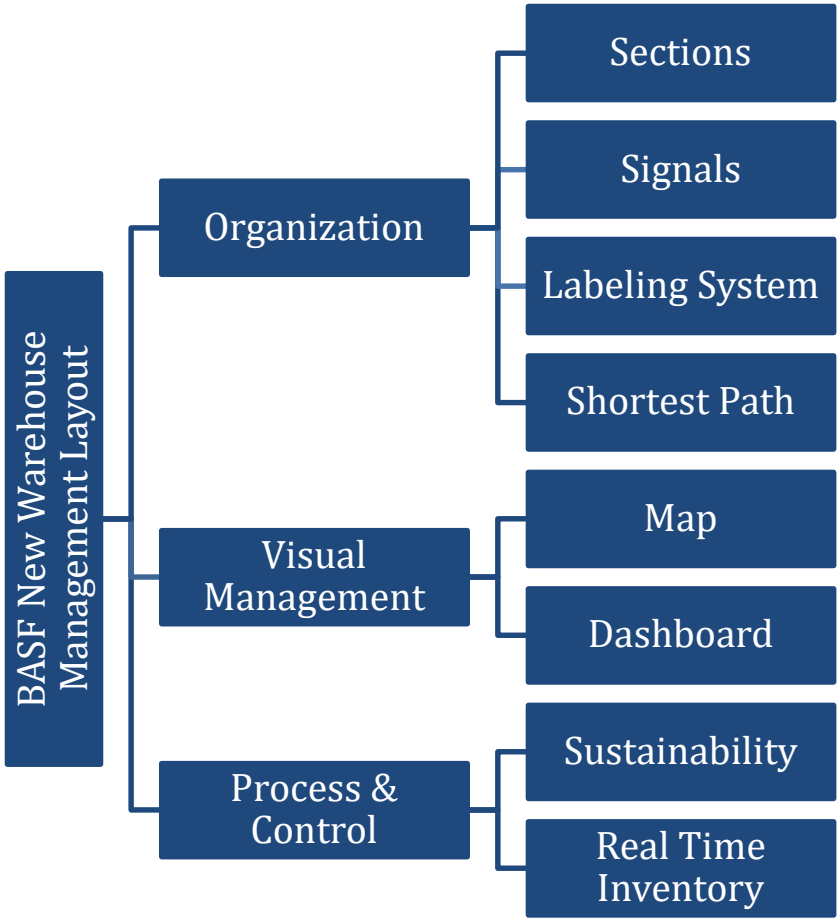


Figure 10: Voice of Customer