

I PRO 345 Final Report  
Spring 2010

# Improving Food Packaging Processes Using Process Mapping Techniques



Advisor: Philip Lewis

### Executive Summary

This report contains information on the project which IPRO 345 team members worked on in the spring of 2010. The project was sponsored by Land O’Frost, a meat processing company that has been in existence for 50 years. The main purpose and objective of the IPRO was to increase efficiency in the formulation area of Land O’Frost’s Lansing plant by suggesting a new plant layout and conducting a 5S analysis of tools used in Formulation; Formulation encompasses ordering raw materials, blending the recipe of each meat product, curing and baking.

**Comment [J1]:** This section would be stronger if you clearly stated what the problems are that Land O’ Frost is currently facing.

The team made several visits to the plant in Lansing, Illinois to observe plant operations in the Formulation area. The team gathered information that was used in our analysis by interviewing some of the plant workers and meeting with the plant managers. The team acquired the existing plant layout and took inventory and pictures of the tools presently being used in the Formulation. Based on all the data collected, the team designed a number of new plant layouts and chose the best layout to be presented to our sponsor. The team standardized tools by taking employee preference into consideration and made recommendations based on tool efficiency. Finally, the team presented its findings, results and recommendations to Land O’Frost in a presentation to Matt Henderson, the Process Improvement Manager, and other supervisors on April 30<sup>th</sup>, 2010.

Due to a confidentiality agreement IPRO 345 team members signed with Land O’Frost, the team is unable to disclose all its findings with the IPRO Office and the public. Please see Appendix 2 for a copy of the agreement the team members signed.

### Purpose and Objectives

The IPRO 345 project is sponsored by Land O’Frost, a company that has been in the meat processing business for 50 years. Land O’Frost is a family owned business and offers a variety of lunchmeats: turkey, ham, beef and chicken. Land O’Frost has three manufacturing facilities in the United States. The company’s headquarters is in Lansing, Illinois. The company has two other facilities in Madisonville, Kentucky and Searcy, Arkansas. It is estimated the Lansing plant makes between \$100 and \$500 million in revenue each year and employs between 500 and 1,000 people.<sup>[1]</sup> On average, the Lansing plant produces one million pounds of deli meat each week. The production process has two stages: Formulation and Packaging. The Formulation stage encompasses ordering raw materials, blending the recipe of each meat product, curing and baking.

**Comment [J2]:** How big is Land O’ Frost? List annual revenue, number of employees, pounds of lunchmeat processed in the Lansing plant, etc.

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The purpose of this IPRO was to better understand the interdependent relationship of the Formulation process and its impact upon through time, productivity, and quality. Inefficient utilization of available resources not only costs the company fortunes, but also affects the market adversely. The team looked to implement improvements to Land O’Frost, using the 5S methodology, by optimizing their Formulation and increasing productivity and efficiency while reducing cost.

The team focused only on the Formulation area of the plant and Land O’Frost identified two major problems. The first problem was the arrangement of the machines in use in Formulation. Over the years, the plant has expanded and machines were placed wherever there was room, without any structure. As a result, the plant is now facing congestion and obstruction of general traffic flow in certain areas. The second problem was the use and storage of tools. There are several kinds of tools performing the same functions and the tools are stored in non-designated locations in the plant, causing “search time” to the operation.

The first problem was addressed by gathering data from plant visits and designing a new plant layout that will reduce congestion and improve general traffic flow in Formulation. The team tackled the second problem by standardizing and suggesting storage locations for the tools.

### Organization and Approach

The plant layout group's deliverable was to create an alternative floor plan that would decrease congestion, optimize space and improve traffic flow and overall productivity. Using such tools as spreadsheet templates and AutoCad to visualize and collect data, the team identified, first, the current problem areas and product flow, followed by constructing a variety of floor plans analyzing this data. Numerous observations were made during plant operation, including measuring machine size and floor space, recognizing input and output locations and tracking individual products through the Formulation process. The team met several times with maintenance and floor managers and discussed observations and tentative floor plans. These discussions detailed facility requirements and restrictions in machine relocation and product lines. Then the team members individually constructed alternative plant layouts. These plans were created with AutoCad and team members indicated product flow, relative cost and relocation timeline. After several discussions, the group revised and improved upon these plans. Once the best plan was chosen, a cost justification was created using the specifications given by Land O’Frost. For the plan, along with a cost justification, a timetable and order in which to relocate machinery was suggested.

The team started the study of tools by cataloging them, noting their current storage location, the frequency of their use, and employee preference between tool varieties. The team first created an inventory of all tools in Formulation and noted current tool storage locations. A spreadsheet was made with a list of tools specific to various areas and tasks, and frequency of each task. Over fifty tools were inventoried. Many tools served the same purpose. In addition to the data collected, interviews were conducted with employees to find and understand their tool preferences. Over several visits to the Lansing plant, the team interviewed the same employees with different questions each time. Please see Appendix 3 for interview questions. From the team’s knowledge of each tool and its use, recommendations for the most efficient tools and the best storage locations were presented to the sponsor.

**Comment [J3]:** Give figures of these things so that we have an idea of the scope of your work.

**Comment [J4]:** Which employees did you interview? How many people? How many times did you interview each person? How long were the interviews? What questions did you ask? It would be good to include as appendices both a log of the interview (who, when, how) and a list of the questions that you asked.

### Analysis and Findings

During the first visit to Land O’Frost’s Lansing plant on February 3<sup>rd</sup>, 2010, the team met with Matt Henderson, the Process Improvement Manager, and he presented two projects. Subsequently, the IPRO team was divided into two sub teams based on the two projects: (A) ~~To~~ propose a new plant layout in the Formulation area to improve productivity and decrease the congestion areas, and (B) ~~To~~ standardize and suggest storage for existing tools.

(A) ~~Project 1~~: Proposing a new plant layout in the Formulation area:

After the first visit, the team decided that in order to come up with any suggestions for the rearrangement of the machines, the problem areas had to be identified and data had to be gathered. To gather data, a plant floor plan was necessary. On the next plant visit, the team decided to make a copy of the drawing on hand to help gather data and put observations down on the drawing. During the second plant visit, on February 22<sup>nd</sup>, the team ~~came to understand by~~ ~~observing~~ the traffic around the machines, identifying ~~the~~ bottlenecks, ~~the~~ production processes, ~~the~~ variety of products produced, and ~~the~~ frequency of machine use.

Comment [J5]: How did you record this data?

On this visit, the team members also observed that the drawing of the plant floor plan was not the same as the current plant layout. The team identified the new location of the machines in the plant and documented them, including the missing walls. Along with updating the drawing, team members also cataloged the inputs and outputs of each machine and recognized the limitations in moving or rotating the machines for consideration in the new plant layout.

On February 23<sup>rd</sup>, a team member from each team visited the plant. ~~By~~ ~~Visiting~~ the plant on different days of the week and at different hours ~~to~~ ~~allowed~~ the team to collect data on different product lines. On the same visit, members of the team spoke with Steve Keilman, Line Supervisor, and gained invaluable information about the Formulation process.

After the second visit to the plant, the team updated the floor plan and made a rough drawing of the machines, which would help the team come up with potential ideas and suggestions that could be made to the company. The team brainstormed possible machine relocations. However, the need for an accurate, to-scale drawing of the floor plan to see if the machines would fit in the new location was recognized.

On obtaining an accurate floor plan with all machines drawn to scale, the team met to decide if the new ideas could be realized. While discussing the possibilities, many questions arose. To find ~~the~~ answers to the questions, the team had to make a third plant visit to talk with the Process Improvement Manager and others involved in the project.

On March 29<sup>th</sup>, 2010 a third visit to Land O’Frost was made. The team had a meeting with Matt Henderson, the Process Improvement Manager, where ideas were presented

and the team received feedback on those ideas. Prior to this, it was thought that only some of the machines could be moved due to power requirements and pre-existing wiring. On this plant visit, the team was assured that everything could be moved but to keep in mind the time and the work force needed for the rearrangement. The team was also reminded of the fact that some of Formulation will be shut down while the machines are moved. After the meeting, team members went into Formulation to observe and have a better understanding of the space.

During the next class meeting, the plant layout subgroup presented to the other team members what had been observed so far and some of the new ideas after the most recent plant visit. The plant layout group met to brainstorm new ideas for the final plant layout to be presented to the plant. During that meeting, it was decided that it was best if each one of the team members came up with their own suggestions and presented them to the class at the next meeting.

The next step was to combine all ideas to come up with a final plant layout and draw it in AutoCAD and give the new drawing to the tools subgroup so the best placement and storage of the tools in the new layout can be decided.

#### (B) Standardization of Tools and Storage Suggestions:

After the first plant visit on February 3<sup>rd</sup>, 2010, the tools subgroup decided to come up with a spreadsheet where tools would be catalogued. The spreadsheet was used to record the type of tool, its current storage location, the frequency of its use, and the employee preference of each tool. This spreadsheet would help to record all the tools in an organized manner and give an entire description of the tool.

Once the spreadsheet was finalized, a second plant visit was made on February 17<sup>th</sup>, 2010. After cataloguing the tools, the team had a short meeting with one of the floor managers to ensure that everything was covered. A follow-up discussion was held in class to analyze the tools and begin working on standardizing the tools, which was the main scope of this project.

In the process of standardizing tools, every tool in the formulation section was discussed in detail. Further analysis helped the team to narrow down multiple types of tools used for the same processes. However, many questions surfaced for which answers were critical before any progress could be made on the project. For example, the team could not specify the exact task of a particular tool. Therefore, a set of questions was prepared that needed to be answered and also a small presentation was prepared to update the company of our progress and to receive feedback. Please see Appendix 4 for questions that the plant answered.

Our third visit on March 24<sup>th</sup>, 2010 comprised of three aims: (1) discussing the standardization of tools with the company, (2) obtaining answers to the questions, and (3) re-confirming the inventory of tools. After presenting the preliminary findings, positive

**Comment [J6]:** How many questions? Include them as an appendix.

feedback was received and the rest of the visit was solely focused on identifying the technical reasoning behind standardizing specific tools and obtaining answers to the questions and re-confirming the inventory of the tools.

During our in-class discussion, the team finally standardized the tools and provided reasons for the decisions as shown in the table below.

TOOL	TOOL TYPES	SOLUTION
Shovel	3 types of shovels used: (a) <i>Red Plastic shovel</i> - to pick up meat that has fallen on the floor (b) <i>Green Plastic shovel</i> - to move meat in the machines (c) <i>Metal shovel</i> - to move meat in the machines	<ul style="list-style-type: none"> <li>- Since the green and the metal shovels are being used for the same purpose, we decided to standardize them and only keep the metal shovels and remove the green plastic shovels.</li> <li>- Moreover, they are the same weight and it would be more efficient to use the metal shovel vs. the green plastic shovel, since the plastic shovel tends to bend from the weight of the meat.</li> <li>- The red plastic shovel should be still kept since the color differentiated its use and the shovel's material is not a problem because it is used to lift smaller quantities of meat that falls on the ground occasionally.</li> </ul>
Rakes	3 types of Rakes: (a) 'High-bar' rake with 3 or 4 teeth: used in the macerator/mixer (b) 'Low-bar' rake with 4 teeth: used in grinders (c) 3 teeth Rake with no bars: occasionally used to move meat	<ul style="list-style-type: none"> <li>- We decided to standardize all the rakes to 'high-bar' rakes since it would serve all rake purposes.</li> <li>- 'High-bar' rakes with 4 teeth should be used in the grinders so that they have more range while grabbing meat.</li> <li>- 'High-bar' rakes with 3 teeth should be used in the mixers/macerator because they are lighter and easier to maneuver.</li> </ul>

Mass Scraper	(a) The tool is too long and heavy to be used (b) Used occasionally	Replace it with a rake and attach an extension.
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While discussing the inventory of tools, the team found that the tools in Formulation were not in the same locations where they were previously found. This brought the team to the second part of the project which was to propose storage locations for the tools. Since the overall project revolved around proposing a new plant layout and standardizing tools while suggesting storage locations, it was decided that this could not be tackled until the new plant layout was confirmed. Once the new plant layout was finalized, the team looked into the wall spaces available and the machine positions to propose ideas for storage locations.

While the team was waiting on further information for storage of tools in the formulation area, appropriate storage options for the spice room tools, mainly scoops, were suggested. Since only 9 scoops were present for the 9 ingredients, the team decided to keep the scoops in the buckets with the ingredients since there were very few. The scoops would be attached to the buckets with cords so that the scoops would not go missing or be mixed up with other ingredients.

Conclusions and Recommendations

(A) Proposing a new plant layout in the Formulation area:

The plant layout group observed heavy traffic flow in the north room in Formulation. The major cause for the congestion was the deboxing area in the north side of the Formulation area. The team suggested some solutions to decrease congestion and reasons for each of them. A variety of floor plan layouts were created in order to spread out the queue lines in an effort to improve the traffic flow. Finally, the team assigned queue lines to reduce overlapping. The team suggested placing symbols on the wall to designate a queue area for each machine. By rearranging machines optimally, the team presented a more effective plant layout to Land O’Frost.

(B) Standardization of Tools and Storage Suggestions:

After observing the tools in the Formulation area, the tools group discovered several areas where tools are used that could be modified to increase productivity and organization. In the spice room, the group observed that the scoops and knives and other tools in the room did not have a designated storage area. Instead, they were placed randomly on tables, and some scoops were left in the spice bins. The group suggested attaching the handles of the scoops to the bins with cords so that the scoops don’t go missing. In the Grinding area, the employees explained to the group that the green plastic shovels were uncomfortable to use because they bent under the weight of the meat. The group suggested replacing these shovels with hollow metal ones so they are not heavy and will be able to hold more weight. For tools in the Grinding area, the group suggested

welding hooks to machines so that each tool could be hung on the machine it is used with. It was also suggested to place hooks on the walls, but only after the rearrangement of machines has taken place. The group suggested that only the rakes with low bars should be kept to promote safety, as the low bars keep the teeth of the rakes as far away from the grinding mechanism as possible. It was further suggested that the four teeth rakes be kept to use with the grinders, while the three teeth rakes be used with the mixers. There was also a meat scraper stored next to the 10K mixer that was used to dislodge frozen meat stuck to the vats when dumping. The group suggested getting an extension that could be used on normal rakes, to make them longer, or replace the meat scraper with a rake that was just as long, but lighter.

[1] "Land O Frost Inc – Lansing, Illinois (IL) Company Profile." Manta, 2010. Web. 28 April 2010.



Appendix 1: Team Members and Revised Project Budget

Team Members

Name	Major	Email	Phone Number
Remi Adejinle	Chemical Engineering	radejin1@iit.edu	[REDACTED]
Kathleen (Kate) Baker	Chemical Engineering	kbaker6@iit.edu	[REDACTED]
Wojciech (Peter) Blaszyński	Biology	wblaszyn@iit.edu	[REDACTED]
Pankti Gala	Biomedical Engineering	pgala@iit.edu	[REDACTED]
Chathuri Gunasekera	Biomedical Engineering	cgunasek@iit.edu	[REDACTED]
Adam Kuuspalu	Biochemistry	akuuspal@iit.edu	[REDACTED]
Crina Popa	Architecture	cpopa@iit.edu	[REDACTED]
Olakunle (Kunle) Popoola	Chemical Engineering	opopool2@iit.edu	[REDACTED]
Nicole Reigle	Chemical Engineering	nreigle@iit.edu	[REDACTED]
Deepthi Veliyathuparambil	Chemical Engineering	dveliyat@iit.edu	[REDACTED]
Phil Lewis	Advisor	lewisp262@aol.com	[REDACTED]

Project Budget

Total Miles per Trip (Roundtrip)	44.4
Reimbursement Rate*	\$0.50/mile
Number of Trips	9
Total Reimbursement	\$199.80

Appendix 2: Land O'Frost Confidentiality Agreement

**AGREEMENT TO KEEP INFORMATION ACQUIRED  
CONCERNING LAND O' FROST CONFIDENTIAL**

We, the undersigned, realize that Land O' Frost, Inc. and its affiliates ("Land O' Frost") desire to keep various information about its interests and activities confidential, including not only information about its technologies, packaging activities, production processes, research, marketing information and other internal activities but also information about what goods and/or services Land O' Frost desires to purchase and the uses to which Land O' Frost might put such goods and/or services, and also information about those product lines or areas in which Land O' Frost is becoming active or might have any interest.

We, the undersigned, desire to deal with Land O' Frost for the purpose of selling goods and/or services or to participate in Land O' Frost' commercial activity in the project area identified below, and in the course thereof, Land O' Frost may furnish us with certain of the above information such as technical information including drawings, data sheets, process conditions, recipes, product formulations and ingredient specifications or marketing information such as marketing plans, promotions, new product introductions or promotional tie-ins and we may acquire other such information concerning Land O' Frost, possibly from conversations with Land O' Frost' personnel or from our own observation of Land O' Frost' activities. We understand that some or all of this information may be confidential. Therefore, we will use every reasonable effort to keep confidential any business dealings we have with Land O' Frost, including any discussions with Land O' Frost, and also any of the above information concerning Land O' Frost or Land O' Frost' products that we might acquire as a result of our dealings with Land O' Frost. We also agree to use the Land O' Frost information only for the benefit of Land O' Frost.

It is understood in the course of fulfilling our business commitments that possible we may have to communicate some of this information to other people in our company or affiliated companies, but in such a case, we will inform them of the confidential nature of the information and make them aware of their responsibility of keeping such information confidential, and we will use every reasonable effort to see that they do keep such information confidential.

However, any commitment as to confidential information shall not extend to: information we already possess at the time of disclosure by Land O' Frost; information which is in or which comes into the public domain from a source other than ourselves; information developed by us independently and without reference to any information communicated by Land O' Frost; and information that comes to us from a third party source not under obligation to Land O' Frost to maintain the confidentiality thereof.

We also understand that any drawings, data sheets, or other materials given to us by Land O' Frost remain the property of Land O' Frost and must be returned upon request to Land O' Frost at the end of any negotiations or the completion of our work for Land O' Frost.

Brief Description of Project: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Land O' Frost, Inc.**  
Signature: [Signature]  
Your Name: \_\_\_\_\_  
Title: \_\_\_\_\_  
Date: \_\_\_\_\_

Agreed on behalf of:  
**Vendor Name:**  
Signature: [Signature]  
Your Name: Pamela Gale  
Title: Student - IIT  
Date: 2/3/10

Appendix 3: Employee Interview Questions

General Questions: asked for each tool

- (1) What is the purpose of this specific tool?
- (2) Why is there a difference between two similar looking tools and its importance?
- (3) Do you feel more comfortable using a specific tool?
- (4) Why do you prefer using a particular tool over the other for the same purpose?
- (5) How would you feel about a specific change made to a specific tool?
- (6) Could you explain how this process works and the necessity of the tool in that process?

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Specific Questions:

- ~~(1)~~(7) What is the large hook used for?
- ~~(2)~~(8) Why do you have green and white paddles and what is their purpose?
- ~~(3)~~(9) How is the barrel opener used?

| Appendix 4: Lansing Plant Questions

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- (1) Are there any other tools in any storage locations other than the existing tools within the formulation area?
- (2) Are there any specific tasks for each shift?
- (3) How often the tools are cleaned between each shift?