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Study of the application of Lean Manufacturing techniques in the food industry

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# **Study of the application of Lean Manufacturing techniques in the food industry**

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## ABSTRACT

The study is prepared to learn how to start the applying Lean manufacturing techniques in the small food industry company.

A summary of two books was prepared as a theoretical introduction to the implementation of the Lean Manufacturing system.

The client is Albina Snacks AB in Sweden – Helsingborg. The company produces roasted nuts and dried fruits and has many considerable national and international customers. The author of this study, me, works as quality and plant coordinator.

The experiments in the study are limited in tow departments, the roasting, and the packing. this study is an introduction to create basic metrics and measures which consider the backbones of any lean project.

These metrics gave an unpromising feedback about the big wastes which the company has. To eliminate the wastes two Lean manufacturing techniques, as the experiment, have been used the Total Productive Maintenance and Root cause analyze.

In the purpose of deepening the understanding the project implementation in practice, two surveys were performed.

The first one is an external survey about Lean Production in Food Industry, which aims to view the experience of other companies and persons in the related fields.

The second one is internal about Lean Production in Albina Snacks, which aims to view the experience and thoughts of the staff in the company and get more understanding of the staff point of view.

After browsing the results of experiments and the surveys, the main conclusions are:

- To success the Lean Project, the management should adopt the philosophy and share the ideas with all employees with all levels.
- The importance of creating the database and statistics as guidelines for continues improvement.

## 1- Introduction:

If any director is asked about the biggest problems in his organization, the answer will be one of the followings delay in orders delivery, the complaints from customers, overhead cost, the staff performance, machines efficiency, rework due to defects or chaos in stores ... etc. The normal supposed question would be: Isn't there a management system and procedures which should be followed? Of course! The answer will be.

Although most organizations have procedures, routines, quality departments, reports, and forms to maximize the performance of the organization, indeed those rarely achieve the desired goals.

The essential question is why the current system does not address these previous major issues? Most companies design the operating system during the establishment stage, then they enforce the practical execution to imply the precast system. But the Lean manufacturing philosophy is exact on the contrary.

Applying the Lean philosophy puts the horse ahead of the cart, at the variance of other systems, which measures all details and creates a database and a bank of information, then analyses them by using suitable tools. Lean Production helps to select the proper technique to figure the problem.

Lean production is an integrated system and it is possible to apply to all kinds of organizations. But it is impossible to copy and move it from another organization. It is unique i.e. each company should create its methods and experience.

Beside the application of Lean manufacturing is unique, the food industry is also unique for many considerations. The food industry is a public issue which related to all people, the government politics and the food security in the country. The market has a huge competition, so it is very hard to get consumer sanctification.

This thesis is an additional research on the application of Lean production in the food industry. The characteristics of this study are how to start up Lean manufacturing techniques in a small food company and highlight barriers which prevent and delay the implementation.

## **1.1 Background:**

After my assigning as quality and plant coordinator in food industry company (Albina Snacks) last year, I observed that there are many considerable issues like absence of reference database, delay in delivery, wastes in time and materials, repeated stopping in production ... etc.

This was a huge challenge for me that how I can minimize these problems and reduce wastes and improve the quality. Every try was crashing with the absence of clear leading system.

After my knowledge of the Lean Production philosophy, I felt that I found my treasure. So, I decide to match between my work and my study through applying Lean production techniques in the enterprise where I work.

### **1.1.1 Presentation of the client:**

The main activities in Albina Snacks are roasting and packing various types of nuts and packing dried fruits. It was established in 2009 in Helsingborg on area 3400 square meter.

Now Albina Snacks has:

- Nearly 52 employees.
- Three roasting machines 9 ton/ shift. (1 automatic & 2 semi-automatic).
- Four bags packing liens 93600 bags/shift (3 nuts+1 dried fruits)
- One line for cans packing 4680 cans/shift.
- Many decent domestic and international customers (Ikea Food, Coop, and Risenta ... etc.)

At the end of 2016, the company has lost its major customer which was buying more 50% of the production. The customer justified that for two reasons first is the delay in the delivery and the second is uncompleted orders at the delivery (rests).

Many management meetings were done to investigate the root causes of the crises, and many instructions were given to the team to reduce the cost and the wastes. The management took a decision to hire two more salesmen. But those actions couldn't make a balance.

The forecasting for 2018's turnover will go down also according to the director of the company.

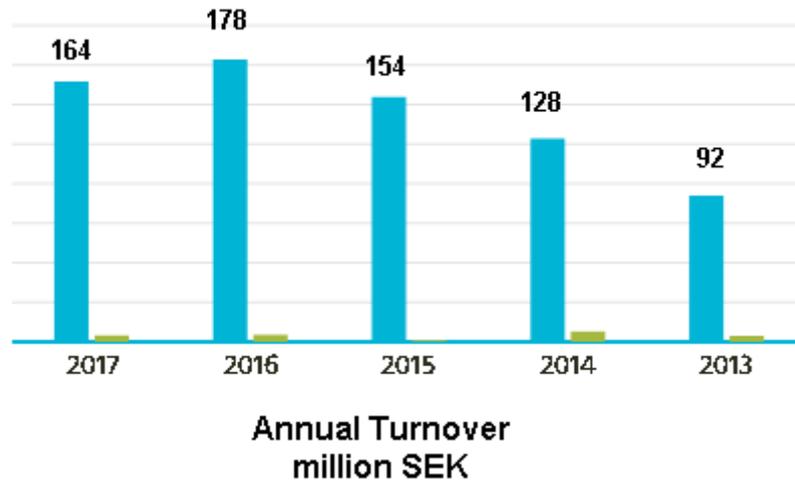


Figure (1.1) Annual Turnover in Albina Snack

## 1.2 Purpose of the study:

The study aims mainly to acknowledge how should start up and implement Lean Manufacturing techniques in food Industry and to investigate the requirements and needs which should exist to apply Lean manufacturing techniques.

To achieve these goals, it should initiate in applying some practical steps which enable us to measure the implementation results. But as it is known, the non-lean enterprises should wait many years to harvest the returns of the application of lean manufacturing philosophy.

### 1.2.1 Problem definition:

- Establish to a statistics system and database to get the required and related metrics and measures in applying the Lean manufacturing system.
- Count the wasted time in the packing section and link the results to the suitable technique.
- Making an internal and an external survey about the implementation of the Lean manufacturing in the Food industry.
- Experiment with the applying of The Total Productive Maintenance (TPM) tool and Root Cause tool.

### 1.3 Limitations:

- This project will be only about the beginning stage of implementation of the Lean manufacturing system.
- Applying of the Lean system requires many months or years to evaluate the benefits and modify the procedures.

- The period of the thesis is limited to three months, therefore only two techniques will be applied.
- The Metrics and Measurements will be only to the nuts factory without the dried fruits line, the offices, and the Warehouses.

#### **1.4 Study Environment**

As I am working as a quality and plant coordinator in the company (Albina Snacks) I decide to match between my work and my study through executing them in the enterprise where I work.

Although the management encourage doing the study, it has not been adapting the Lean philosophy yet. So, there were some difficulties in making the internal survey and applying some techniques which requires more staff and time like 5S tool.

## 2- Methodology:

### 2.1- Alternative methods

To know how should apply Lean manufacturing in the food industry, many steps methods have been followed:

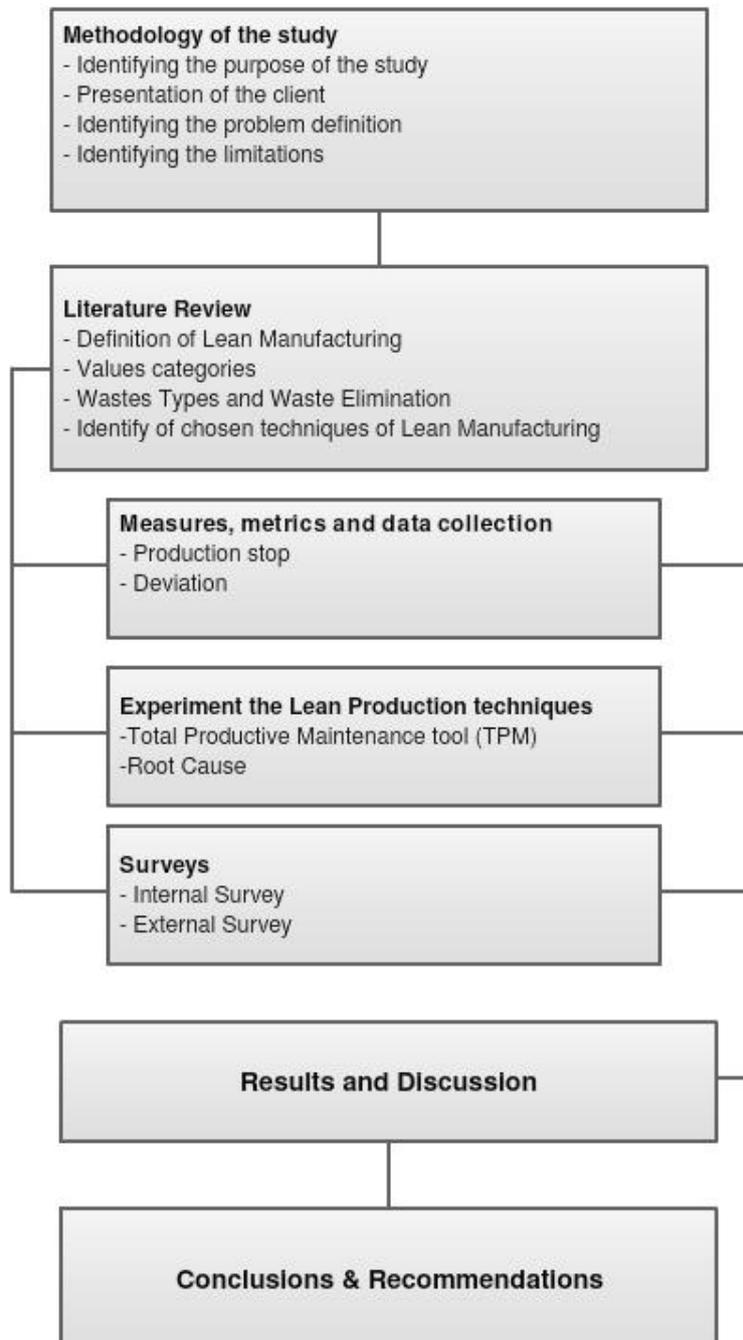


Figure (2.1) Methodology Flowchart

### **2.1.1- Review prior literature:**

To get the knowledge about Lean Manufacturing in general and implementation of the Lean manufacturing in the food industry especially, two books were reviewed. The theoretical background is prepared to meet the goals of the study.

### **2.1.2 Measures and metrics:**

Create a qualitative and quantitative database in the company “Albina Snacks” because there are not any database help and guide the decisionmakers in selecting the proper Lean techniques to eliminate the wastes.

For this purpose, three forms were created and distributed to the workers in production:

- **Production stop report:** it is a quantify report which is filled by operators when the production delays or stops. The purpose of the report is to create statistics about wasted time and categorize the root cause of the wastes. (See appendix 1).
- **Deviation Report:** It is a qualitative report which is filled by the head of the department and followed by quality coordinator/manager. The purpose of the report is to identify the deviations and root causes. Then determine which corrective action and preventive action to avoid repetition of the deviation. (See appendix 2).

### **2.1.3 Experiment the Lean Production techniques:**

- **Total Productive Maintenance tool (TPM):** the applying of TPM aims to increase machines performance and decrease the wastes.
- **Root Cause:** The technique is applied with matching the Production Stop Report and the Deviation Report which mentioned above.

### **2.1.4 Surveys:**

Two surveys were prepared and sent to specific persons. Both surveys include nearly same questions with some changes.

- **Survey No. 1 “Survey about Lean Production in Food Industry”:**

The purpose of this survey is to view the experience of other companies and persons in the related fields.

The survey questions focus on the following thoughts:

- i. The priorities before and during the lean manufacturing implementation.

- ii. The probability of occurrence of many types of wastes.
  - iii. Highest and lowest wastes.
  - iv. The fail and success factors in applying the system.
- **Survey No. 2 “Survey about Lean Production in Albina Snacks”:**
- The purpose of this survey is to view the experience and thoughts of the staff of the company.
- The survey questions focus on the following thoughts:
- i. The familiarity of the staff with Lean Production.
  - ii. The quality of the communication in the company.
  - iii. The priorities before and during the lean manufacturing implementation.
  - iv. The teamwork in the company.
  - v. The probability of some related issues.
  - vi. Highest and lowest wastes in the company.
  - vii. The obstacles to implementing the Lean project.

## 2.2- Preparation and data collection:

The method of data collection differs from a category to another one, anyway, most of them have been done under my supervision and with direct contact with the worker who contributed, each one according to her/his duties:

- **Production stop and Deviation reports** are filled as hard copy by the operators and are confirmed by production supervisor. Then I collect reports, verify information, and fill them in Excel Sheet. In this study I will focus on only 6 weeks (W9 – W14).
- **Count of the rejected products due to a defect in packing:** This number is taken for one production line by record the quantity of the rejected bags. To ease the task, instructions are given to one operator to write down the number of bags which appears on the automatic scale then this amount is deducted from the packed amount.
- **Total Productive Maintenance:** The line’s operators and section’s supervisors are informed to list the faults and deficiencies which cause delay in the production and cause waste in materials, time, performance, and productivity. All lists were collected in one and a priority degree is given to each item. Many meetings with maintenance team were done to discuss the list and create a time schedule to close these items.

- **Surveys:** Both the internal and external surveys were done in a website for free survey [www.surveymonkey.com](http://www.surveymonkey.com).

The External Survey was sent via LinkedIn to nearly 200 persons who work in various industries in Sweden and Europe. After following up and reminding, 29 persons answers all questions.

The Internal Survey was sent to ten employees in Albina snacks. The target employees who work in the head office and have positions as Director, Quality, sales, purchase, and account departments. Four employees only answered the questions.

### **3- Theoretical Background:**

What is lean manufacturing?

Why should companies apply lean?

What are the fundamentals of lean manufacturing?

How do companies apply lean manufacturing techniques?

There are many books and references can give answers to these questions. But in this article, I will try to give specific and brief answers to get more helpful understanding during applying lean manufacturing in the target company.

#### **3.1 Summary of the literature study and state-of-the-art**

##### **3.1.1 About references:**

After long searching for references, I decided to pick up 2 books and two prior articles are talking about applying Lean Manufacturing generally in the industry and particularly in the food industry. References are as follow:

- Lean Manufacturing That Works: Powerful Tools for Dramatically Reducing Waste and Maximizing Profits was written by Carreira, B. (2005), and was published by Lean Manufacturing, AMACOM: a division of American Management Association, New York, NY.

Carreira wrote in the book introduction “This is a book about how to put lean manufacturing to work to improve your particular business. ... This book is a more "everyday" approach to the topics under discussion, with enough detail and illustration of some of the basic tools of lean to give the reader a clear view of how to implement (do) what we are talking about”

- Handbook of Lean Manufacturing in the Food Industry was written by Dudbridge, M. (2011), and was published by John Wiley & Sons, Incorporated Publications.

“This book has been written to act as a source of information and ideas for people working in the demanding world of food manufacture. The aim is to provide food industry personnel with methods of increasing efficiency, reducing waste, lowering costs, and improving control in their factories. It will also point the way to less breakdowns, reduced quality faults, increased teamwork and improved profits.”

##### **3.1.2 - Definition of Lean Manufacturing:**

Definition of Lean Manufacturing differs from a reference to other

Dudbridge explains the concept of Lean manufacturing “Lean Manufacturing is a series of techniques that, if applied correctly, will improve the performance of a

factory, a department or even a single production line or machine. The techniques of Lean Manufacturing are logical and as the techniques are applied, it can be thought of as a journey towards a more efficient future.” (Dudbridge, 2011).

“At the center of the lean philosophy is measuring all activities from the customers’ point of view.” (Carreira, 2005).

These definitions leader us to illustrate three major concepts which consider the cornerstones of Lean production value-added which related to the customer, wastes elimination and Lean production techniques (tools).

### **3.1.3 – Values categories:**

In Lean production system the main attention is paid to the customer’s point of view, so all activates and processes in production chain are classified according to the value which related to the customer to three categories:

#### **Value-added:**

“Value-added refers to activity that makes a product a more complete product.” according to Carreira. In other words, any step of production contributes in shaping and changing in the final product completion and deliver to the customer. “Our customers value these activities and are willing to pay to have them performed. The bottom line is, when we do these things, we get money for doing them”. (Carreira, 2005).

What is the importance of the value-added and how could be recognized? Carreira mentions to “Two important notes: 1. the definition of value is always in the eyes of the customer. 2. The end result of this cycle of activity is the receipt of cash for our actions.”

#### **Non-value-added:**

“This is an activity that does not advance the product to a more complete or finished state, that adds no value in the customer's eyes, and that the customer is unwilling to pay for”. This term is coupling to the wastes term which I will explain it after a while.

#### **Required non-value-added:**

This term is a little fuzzy and confuses the reader, so Carreira explains this through examples. This value is “an activity that has nothing to do with the customer and does not further the product”, and it is not a kind of wastes; ex. A required test by the government, costs are paid to safety and environment issues, costs are paid to account department, overhead costs ... etc.

### 3.1.4 - Wastes Types and Waste Elimination:

Dudbridge highlights wastes in chapter 11 “Waste in a food factory is often easy to see. Wasted food and damaged packaging are easy to identify and the skips at the back of the factory are often full of waste that could, and should, have been avoided.”

The physical wastes in the food industry like wastage of raw and packaging materials are is to define and control, but the risk is in nonphysical wastes because they are not seen.

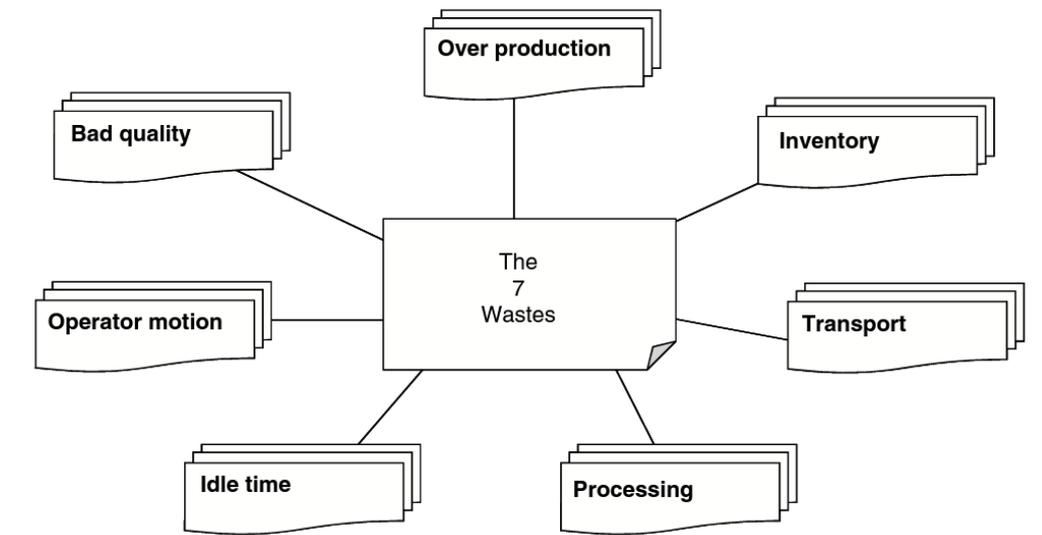


Figure (3.1) the seven wastes that occur in all operations. (Dudbridge, 2011)

#### **Motion (operator movement):**

“Travelling time for hands, people and physical distance between operations is a major cause of waste.” (Dudbridge, 2011). It is possible that reducing the movement by changing the plant layout, machines position or automation the production lines. “It is also possible to ensure that everything is where it is needed, by using some of the techniques used in the 5S system of factory and work organization.” (Dudbridge, 2011).

#### **Waiting Time:**

“There are a huge number of reasons why a production line may be idle and not producing the product. These include: Changeovers, Hygiene, Maintenance, Breakdown, Lack of materials, warming up and Waiting in the machine cycle.” (Dudbridge, 2011).

#### **Overproduction (just in case):**

“Overproduction is building something before you can ship it to someone in exchange for cash.” Carreira, 2005).

### **Optimization losses (over process)**

“Adding unnecessary cost by doing much more than was actually required to provide an acceptable product.” Carreira, p62.

“The size of waste caused by optimisation losses can be difficult to detect, because the true performance of a section of a production line is held back.” (Dudbridge, 2011).

### **Defects (Rejects):**

“Where rejected products are manufactured, it causes waste material, extra effort in rework, unplanned material issues and late deliveries... Defects are probably the worse kind of waste in a food factory.” (Dudbridge, 2011).

### **Unnecessary inventory**

“Unnecessary inventory is inventory that is not needed. Now, how you can tell when inventory is not needed, you might ask. Well here’s a thought: If inventory is sitting idle somewhere (anywhere) in your facility, with nobody working on it, is it needed? There are pretty much only two ways to accumulate inventory that is not needed: buy it or make it.” Carreira, p57.

### **Unnecessary movement**

“This is the waste of people, materials or information around a business. Waste of all types is created by such movement. Moving something does not add any value to it, it just adds cost. This rule applies equally to people, materials and information. The unnecessary movements are a waste of resources and need to be minimised.” (Dudbridge, 2011).

## **3.2 – Applying chosen techniques of Lean Manufacturing:**

As mentioned in the definition of Lean manufacturing is a series of daily minor improvements, the results of applying need long time or many financial cycles to get the benefits and evaluate the feedbacks.

### **3.2.1 - TPM: Total Productive (Preventive) Maintenance.**

“TPM is a system of deterioration prevention and maintenance reduction, not finally fixing machines when they are broken.” (Dudbridge, 2011)

### **3.2.2 - Root Cause Analysis. (5 Whys)**

“The technique is to ask the question, ‘Why do we have such and such?’ and keep asking why to each response. It’s a fast, easy, flowing tool that is fun to use and subject to manipulation” (Carreira, 2005)

### **3.2.3 - Measures and metrics:**

“But the important point is, your metrics control your performance and your business decisions. The second important point is that metrics must be complementary; they must stack up throughout the organization and give everyone the same message. In many organizations, I see people in various areas with conflicting, contradictory, or, worse, no metrics.” (Carreira, 2005)

Carreira assures that the financial metrics and number is using for external propose, but the actual and important measurements which done by the direct labor because they are with permanent and acutely touch with the production and all processes. “

## 4- Results

The result of the study can be presented in the following subtitles:

### 4.1 Results of Measures and metric (the production stop)

As mentioned in chapter 2, the period of these metrics is only 6 weeks (W9 – W14). As mentioned also in paragraph 1.3 the metrics are limited only in the factory.

#### 4.1.1 Changing of Wasted time with the date:

Table 1.4 and Figure 1.4 show the results of the production stop report which were written by the operators. This record for the days when a time has been wasted, the other days are weekends and no wasted time in them.

SN	Date	Wasted Time	
		Minute	Hour
1-	2-26	420	7,0
2-	2-27	420	7,0
3-	2-28	420	7,0
4-	3-1	420	7,0
5-	3-2	420	7,0
6-	3-5	420	7,0
7-	3-6	420	7,0
8-	3-7	420	7,0
9-	3-8	420	7,0
10-	3-9	420	7,0
11-	3-12	420	7,0
12-	3-13	740	12,3
13-	3-14	420	7,0
14-	3-15	540	9,0
15-	3-16	575	9,6
16-	3-19	480	8,0
17-	3-20	460	7,7
18-	3-21	1620	27,0
19-	3-22	450	7,5
20-	3-23	420	7,0
21-	3-29	460	7,7
22-	3-30	180	3,0
23-	4-5	120	2,0
<b>Sum</b>		<b>11085</b>	<b>185</b>

Table (4.1) The wasted time



Figure (4.1) The Daily Wasted Time

To calculate the percentage of the wasted time during experiments period, the total working hours is calculated as follows:

Working hours = 6 weeks x 5 working days weekly x 7hours x 7 machines

Working hours = 1470 hours.

Wasted time percentage =  $(185/1470) * 100 = 12.6 \%$ .



Figure 4.2 Wasted time percentage

#### 4.1.2 Relation between Wasted time and cause category:

Each breakdown in production has a reason, by using root cause analyse technique. To simplify the measures and deal with numeric results, each stop reason was classified under four categories as shown in table 4.2.

Cause Category	Wasted time/Minute	Wasted time Percentage
Maintenance	9620	85,8%
Old facility	1130	10,1%
Planning & Logistic	270	2,4%
Old Machine	165	1,5%
Unclear	30	0,3%
Sum	11215	

Table 4.2 Relation between Wasted time and cause category



Figure 4.2 Relation between Wasted time and cause category

#### 4.1.3 Relation between Wasted time and cause category excluding the breakdown in packing machine No. 2:

Packing machine No. 2 had been broken down totally. The reparation required new motor which was unavailable in Sweden so this required long time to the delivery. Because this situation is an exception and to get normal results, the related values were deducted.

Cause Category	Wasted time/Minute	Wasted time Percentage
Maintenance	1220	43,3%
Old facility	1130	40,1%
Planning & Logistic	270	9,6%
Old Machine	165	5,9%
Unclear	30	1,1%
Sum	2815	

Table 4.3 Relation between Wasted time and cause category excluding Packing Machine No.2

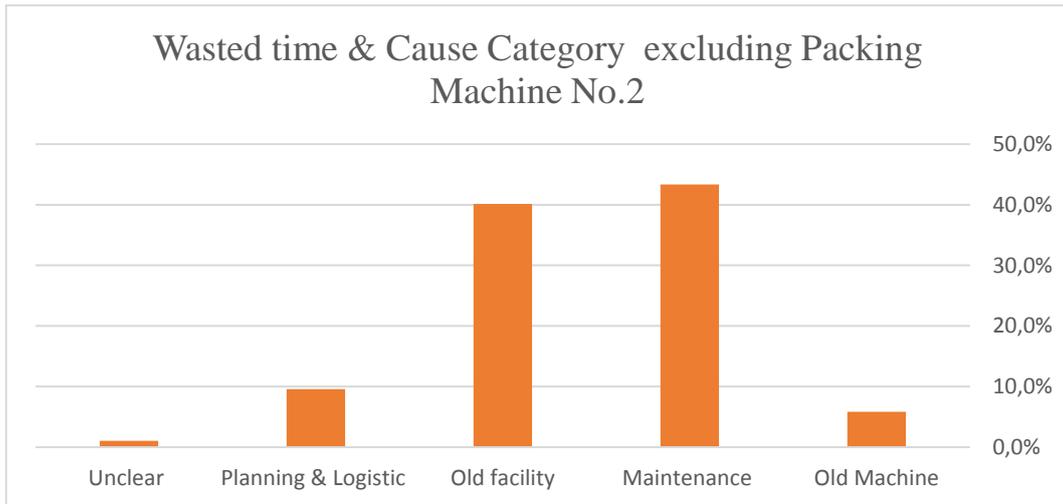


Figure 4.3 Relation between Wasted time and cause category excluding Packing Machine No.2

## 4.2 Results of applying Total Productive Maintenance technique:

A list was created to determine the required maintenances and deficiencies in the factory. This is the first step to apply the Total Productive technique.

32 required maintenances and deficiencies were arranged in the list according to the priority to the production point of view. Nine tasks completed according to last update 2018-05-11.

The tasks were classified according to two deferent concepts:

- I. The deficiency impact: How to affect the mentioned issue on the business and why should fix it. Table 4.4 below shows the abbreviations and the quantity of each category.

<i>Category Abbreviation:</i>		<i>Quantity</i>
<b>Pro.</b>	<i>Productivity.</i>	14
<b>Hyg.</b>	<i>Hygiene.</i>	10
<b>OSH</b>	<i>Occupational Safety and Health.</i>	4
<b>Qua.</b>	<i>Quality.</i>	4

Table 4.4 TPM tasks: business category (Abbreviation and Quantity)

- II. The deficiency category according to The Lean Philosophy: How effects the mentioned issue on the customer and how the issue is classified according to customer's value concept.

Table 4.5 below shows the abbreviations and the quantity of each category.

<i>Values Category Abbreviation:</i>		<i>Quantity</i>
<b>VA</b>	<i>Value-Added</i>	13
<b>VNA</b>	<i>Non- Value-Added</i>	15
<b>RVA</b>	<i>Required Non- Value-Added</i>	4

Table 4.5 TPM tasks: Values category (Abbreviation and Quantity)

The current situation of applying of the Total Productive Maintenance is as shown in the table 4.6 below.

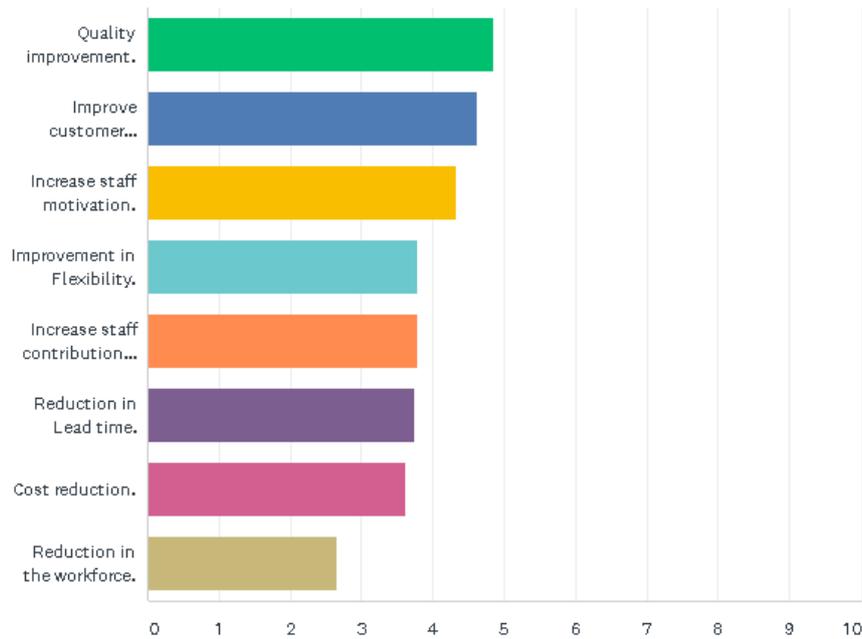
<u>Sn.</u>	<u>Line/ Machine</u>	<u>Required Maintenance / Deficiency</u>	<u>Priority</u>	<u>Cat.</u>	<u>Value Cat.</u>	<u>Due Date</u>	<u>Resp.</u>
1	Warehouse	Rack Protection	<u>10</u>	OSH	RVA	Done	
2	Packing1	Modify the band after machine	<u>10</u>	Hyg.	VA	Done	
3	Packing1	Fix the Euro hole (Ikea + Favorit)	<u>10</u>	Qua.	VA		
4	Packing2	Fix the Euro hole (Ikea + Favorit)	<u>10</u>	Qua.	VA	Done	
5	Packing2	Modify the band after machine	<u>10</u>	Hyg.	VA	Done	
6	Packing2	Welding's plates get stuck sometimes	<u>10</u>	Pro.	NVA	Done	
7	Packing 5	Compressor	<u>10</u>	Pro.	NVA		
8	Packing 5	Elevator	<u>10</u>	Pro.	NVA		
9	Roast.1	Exhaust pipe (soot falls on the food)	<u>10</u>	Hyg.	VA		
10	Roast. 2	A gap between the drum and the machine body (soot fallen on the food)	<u>10</u>	Hyg.	VA		
11	Roast.2	The chain sounds (soot falls on the food)	<u>10</u>	Pro.	VA		
12	Packing1	Packing's Printer Cassette	<u>9</u>	Pro.	VA		
13	Packing2	The blades not sharp, risk of foreign objects comes in production.	<u>9</u>	Hyg.	VA		
14	Packing 2	Packing's printer (Print head)	<u>9</u>	Pro.	VA		
15	Packing	Label Printer	<u>9</u>	Pro.	VA		
16	Factory	Lamps in mixing and warehouse	<u>8</u>	Qua.	NVA		
17	Factory	Labors door	<u>8</u>	Hyg.	NVA	Done	
18	Factory	Fix high pressure system	<u>8</u>	Pro.	NVA		
19	Factory	A big truck	<u>8</u>	Pro.	NVA		
20	Packing 1	A roof to the machine	<u>8</u>	Hyg.	NVA	Done	
21	Packing 2	A roof to the machine	<u>8</u>	Hyg.	NVA		
22	Packing	Fixing vibrators to the floor	<u>8</u>	Pro.	NVA	Done	
23	Roast.	Two plastic or stainless-steel tables to the small roasters	<u>8</u>	Hyg.	NVA		
24	Roast.	Gas detector	<u>8</u>	OSH	RVA		
25	Roast.	Diesel burner nozzle (temperature)	<u>8</u>	Pro.	NVA		
26	Roast.3	Replace all inner steel parts with stainless steel	<u>8</u>	Hyg.	VA		
27	Roast.3	Vibration problem in machine	<u>8</u>	Pro.	VA		
28	Factory	Ventilations system	<u>7</u>	OSH	RVA		
29	Factory	Safety shoes	<u>7</u>	OSH	RVA		
30	Factory	Arrangement the workshop	<u>7</u>	Pro.	NVA		
31	Pack. 4	Stainless steel table	<u>7</u>	Qua.	NVA		
32	Packing	Fix hand truck	<u>7</u>	Pro.	NVA	Done	

Table 4.6 TPM tasks: Current situation. (Last update 2018-05-11)

## 4.3 Results of surveys:

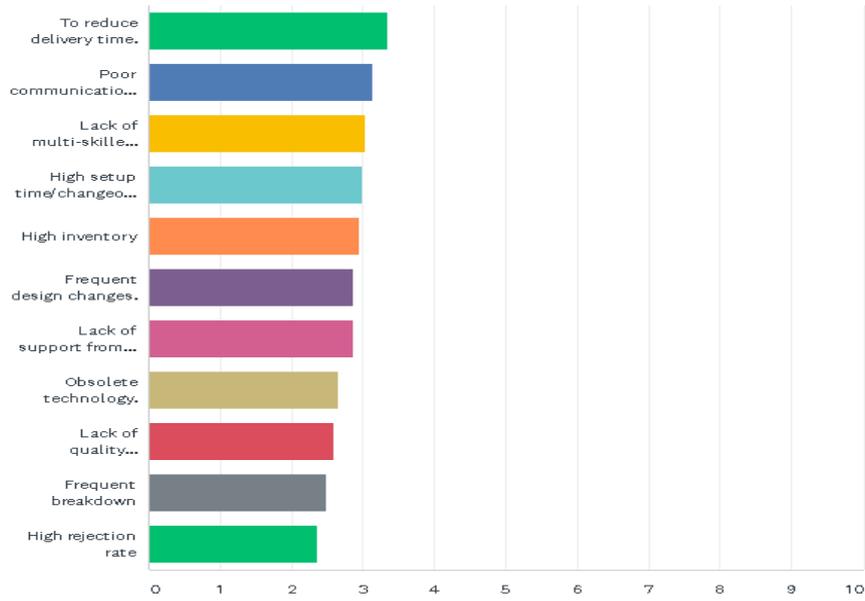
### 4.3.1 External Survey about Lean Production in Food Industry

i. The priorities before and during the lean manufacturing implementation.



	Not at all important	Slightly important	Important	Fairly important	Very important	Total	Weighted average
<b>Quality improvement.</b>	0.00% 0	0.00% 0	3.45% 1	6.90% 2	89.66% 26	29	4.86
<b>Improve customer satisfaction.</b>	3.45% 1	0.00% 0	6.90% 2	10.3% 3	79.31% 23	29	4.62
<b>Increase staff motivation.</b>	0.00% 0	3.45% 1	20.69% 6	13.8% 4	62.07% 18	29	4.34
<b>Improvement in Flexibility.</b>	0.00% 0	6.90% 2	37.93% 11	24.1% 7	31.03% 9	29	3.79
<b>Increase staff contribution to decision making.</b>	0.00% 0	14.29% 4	32.14% 9	14.3% 4	39.29% 11	28	3.79
<b>Reduction in Lead time.</b>	3.57% 1	10.71% 3	32.14% 9	14.3% 4	39.3% 11	28	3.75
<b>Cost reduction.</b>	0.00% 0	10.34% 3	41.38% 12	24.1% 7	24.1% 7	29	3.62
<b>Reduction in the workforce.</b>	10.3% 3	41.3% 12	27.5% 8	13.7% 4	6.9% 2	29	2.66

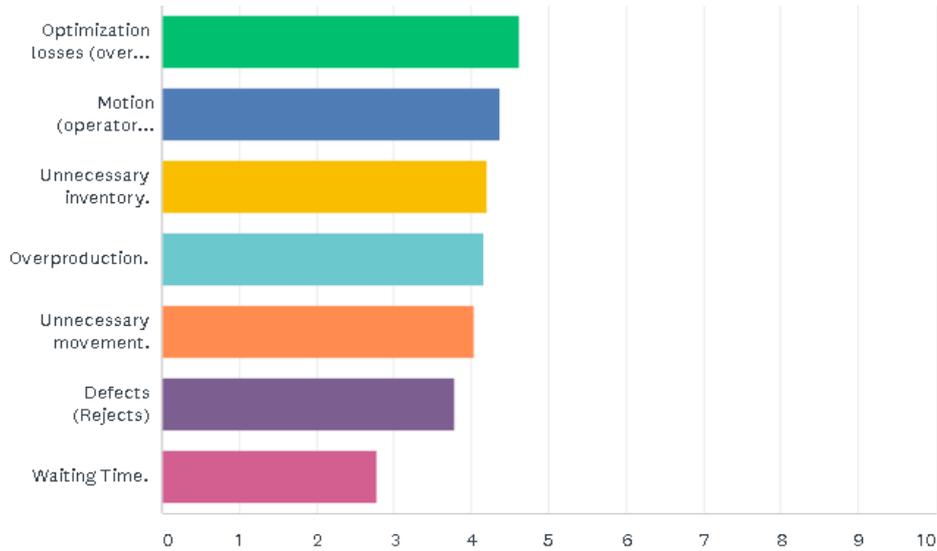
ii. The probability of occurrence of many types of wastes.



	Very unlikely	Unlikely	Possible	Likely	Very likely	Total	Weighted average
<b>To reduce delivery time.</b>	0.00% 0	17.24% 5	44.83% 13	24.14% 7	13.79% 4	29	3.34
<b>Poor communication system.</b>	3.45% 1	34.48% 10	20.69% 6	27.59% 8	13.79% 4	29	3.14
<b>Lack of multi-skilled manpower</b>	13.79% 4	31.03% 9	17.24% 5	13.79% 4	24.14% 7	29	3.03
<b>High setup time/changeover time</b>	7.14% 2	21.43% 6	46.43% 13	14.29% 4	10.71% 3	28	3.00
<b>High inventory</b>	7.14% 2	21.43% 6	50.00% 14	10.71% 3	10.71% 3	28	2.96
<b>Frequent design changes.</b>	3.45% 1	31.03% 9	44.83% 13	17.24% 5	3.45% 1	29	2.86
<b>Lack of support from top management.</b>	17.24% 5	31.03% 9	13.79% 4	24.14% 7	13.79% 4	29	2.86
<b>Obsolete technology.</b>	13.79% 4	34.48% 10	31.03% 9	13.79% 4	6.90% 2	29	2.66
<b>Lack of quality consciousness</b>	20.69% 6	37.93% 11	17.24% 5	10.34% 3	13.79% 4	29	2.59
<b>Frequent breakdown</b>	21.43% 6	28.57% 8	32.14% 9	14.29% 4	3.57% 1	28	2.50

	Very unlikely	Unlikely	Possible	Likely	Very likely	Total	Weighted average
<b>High rejection rate</b>	17.86% 5	50.00% 14	17.86% 5	7.14% 2	7.14% 2	28	2.36

iii. Highest and lowest wastes.



	1	2	3	4	5	6	7	TOTAL	SCORE
Optimization losses (over process)	17.24% 5	24.14% 7	13.79% 4	10.34% 3	20.69% 6	10.34% 3	3.45% 1	29	4.62
Motion (operator movement)	17.24% 5	20.69% 6	13.79% 4	10.34% 3	17.24% 5	10.34% 3	10.34% 3	29	4.38
Unnecessary inventory.	20.69% 6	3.45% 1	27.59% 8	10.34% 3	13.79% 4	10.34% 3	13.79% 4	29	4.21
Overproduction.	17.24% 5	13.79% 4	6.90% 2	24.14% 7	13.79% 4	17.24% 5	6.90% 2	29	4.17
Unnecessary movement.	20.69% 6	10.34% 3	17.24% 5	0.00% 0	17.24% 5	24.14% 7	10.34% 3	29	4.03
Defects (Rejects)	0.00% 0	24.14% 7	17.24% 5	17.24% 5	10.34% 3	17.24% 5	13.79% 4	29	3.79
Waiting Time.	6.90% 2	3.45% 1	3.45% 1	27.59% 8	6.90% 2	10.34% 3	41.38% 12	29	2.79

iv. The fail and success factors in applying the system.

Successes Factors came as follow:

After translating one answer from Swedish to English, gathering and count of same answers, and correct spelling mistakes:

Four persons didn't answer the question.

Two answered with: N/A

Two persons answered with: Planning

Two persons answered with: Quality

Two persons answered with: Unnecessary movement

*“Communication skills must be high. Motivate the staff. Maintaining the high quality of the product”*

*“Correct design / optimized Engineering, cost”*

*“Entire team should realize the significance”*

*“Faithfulness”*

*“Focus on personnel”*

*“Go and check a real-life operation”*

*“Good input”*

*“good planning”*

*“Good relationship between management and the worker's”*

*“Group work”*

*“Lean is a strategy, you have to connect the organizations values, leadership and employee ship into a whole”*

*Translated from Swedish: “Management's commitment, clear SMART goals, everyone's understanding and commitment. “*

*“Motion”*

*“Since I don't know what this Lean project is about it is hard to answer this question”*

*“Staff”*

*“Target decision”*

*“The proper plan and execution is too important. To implement the lean process in food industry”*

*“Value stream mapping can be helpful for refuction in time used for the unuseful things such as travelling between the stations.”*

Fail Factors came as follow:

After translating one answer from Swedish to English, gathering and count of same answers, and correct spelling mistakes:

Three persons didn't answer the question.

*"management" "HR" "finance people"*

*“Management's commitment, as well as all employees' involvement and participation. getting everyone to buy in and participate”*

*“Nothing”*

*“Not sure”*

*“lack of coordinate”*

*“Same as above: “Since I don't know what this Lean project is about it is hard to answer this question”*

*“Staff”*

*“Mapping”*

*“In health care it is of huge value to encourage employees while meeting the set goals, it is very difficult to reach in old structures”*

*“Time management”*

*“Lack of management knowledge about the tool.”*

*“Staff and manager”*

*“Quality”*

*“Suppliers, work force”*

*“Management Responsibility, employee’s motivation”*

*“Financial”*

*“Support from management and to achieve a good working environment”*

*“Man power.”*

*“Management decisions”*

*“Getting it anchored in all of the company”*

*“Communication (bad communication)”*

*“poor design/ poor profit study/ poor engineering”*

*“Potential work”*

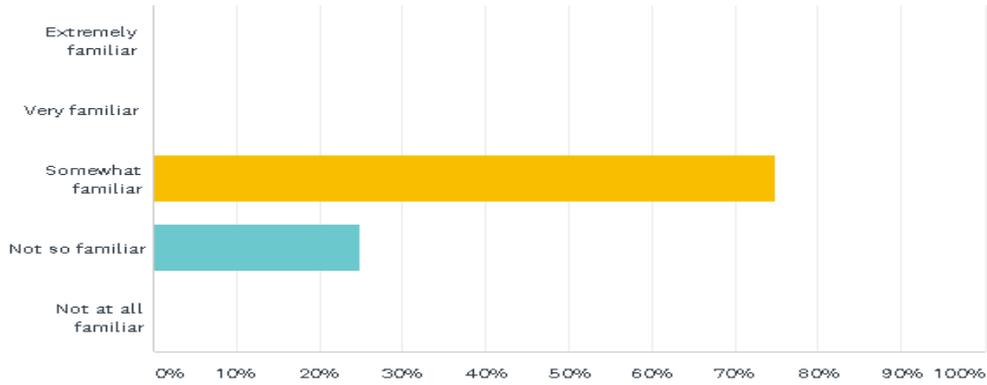
*“Lacking in proper leadership. Bad communication between higher authorities and workers, traces of bottlenecks etc.”*

*“Stubbornness”*

#### **4.3.2 Internal Survey about applying the Lean Production in Albina Snacks**

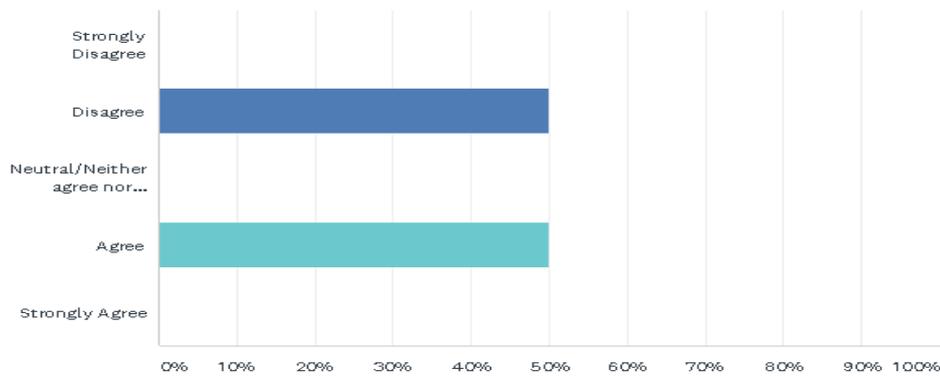
The Internal Survey was sent to ten employees in Albina snacks. The target employees who work in the head office and have positions as Director, Quality, sales, purchase, and account departments. Four employees only answered the questions. The answers came as follow:

- i. The familiarity of the staff with Lean Production.



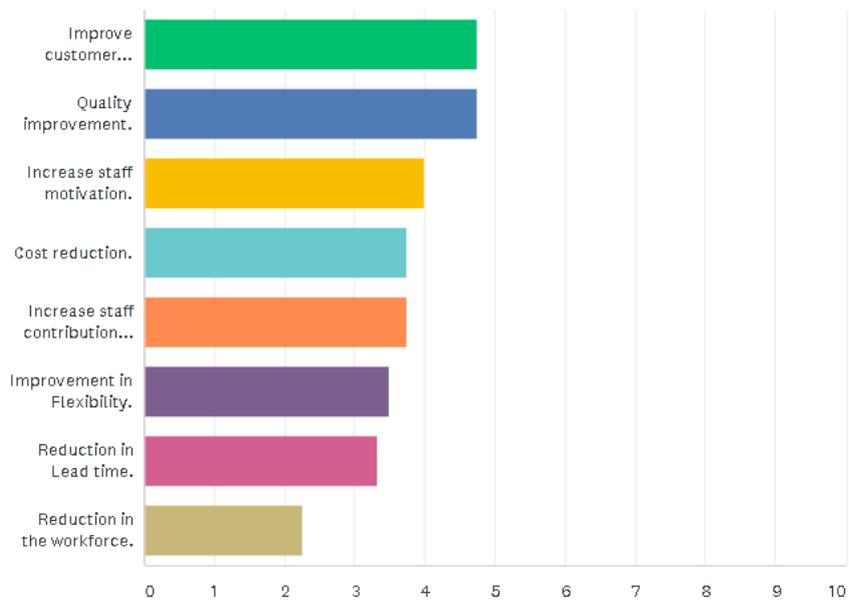
ANSWER CHOICES	RESPONSES
Extremely familiar	0.00% 0
Very familiar	0.00% 0
Somewhat familiar	75.00% 3
Not so familiar	25.00% 1
Not at all familiar	0.00% 0
<b>TOTAL</b>	<b>4</b>

ii. The quality of the communication in the company.



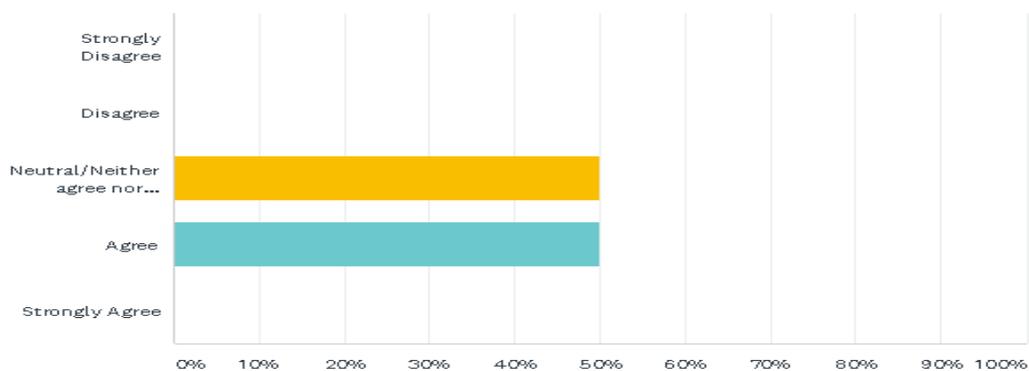
ANSWER CHOICES	RESPONSES
Strongly Disagree	0.00% 0
Disagree	50.00% 2
Neutral/Neither agree nor disagree	0.00% 0
Agree	50.00% 2
Strongly Agree	0.00% 0
<b>TOTAL</b>	<b>4</b>

iii. The priorities before and during the lean manufacturing implementation.



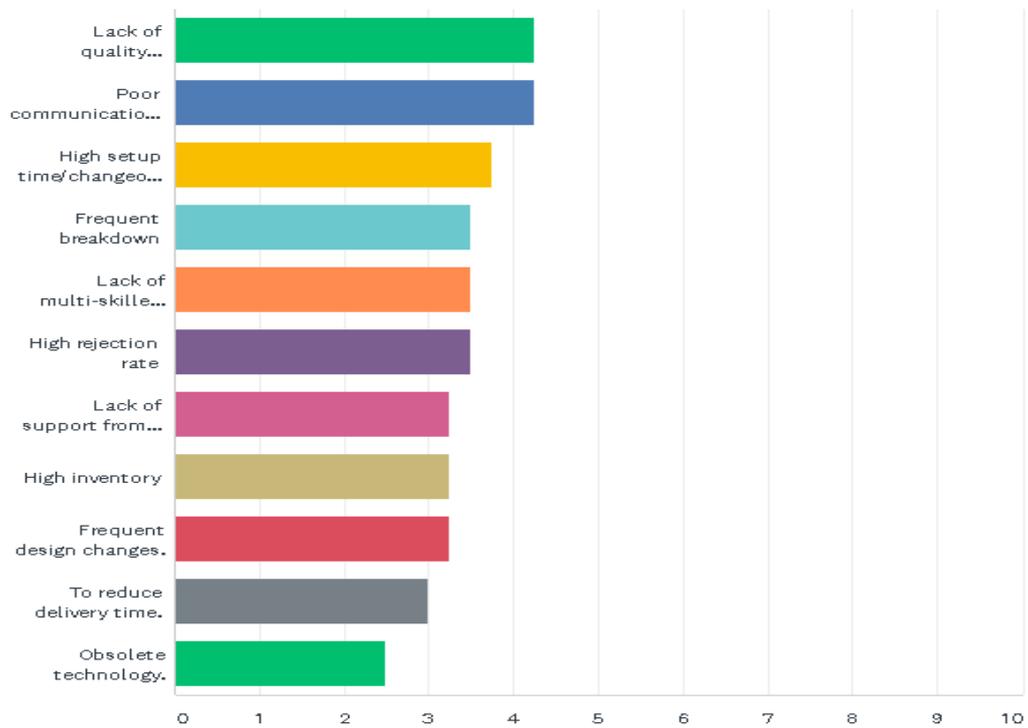
	NOT AT ALL IMPORTANT	SLIGHTLY IMPORTANT	IMPORTANT	FAIRLY IMPORTANT	VERY IMPORTANT	TOTAL	WEIGHTED AVERAGE
Improve customer satisfaction.	0.00% 0	0.00% 0	0.00% 0	25.00% 1	75.00% 3	4	4.75
Quality improvement.	0.00% 0	0.00% 0	0.00% 0	25.00% 1	75.00% 3	4	4.75
Increase staff motivation.	0.00% 0	0.00% 0	25.00% 1	50.00% 2	25.00% 1	4	4.00
Cost reduction.	0.00% 0	0.00% 0	50.00% 2	25.00% 1	25.00% 1	4	3.75
Increase staff contribution to decision making.	0.00% 0	25.00% 1	0.00% 0	50.00% 2	25.00% 1	4	3.75
Improvement in Flexibility.	0.00% 0	0.00% 0	50.00% 2	50.00% 2	0.00% 0	4	3.50
Reduction in Lead time.	0.00% 0	0.00% 0	66.67% 2	33.33% 1	0.00% 0	3	3.33
Reduction in the workforce.	0.00% 0	75.00% 3	25.00% 1	0.00% 0	0.00% 0	4	2.25

iv. The teamwork in the company.



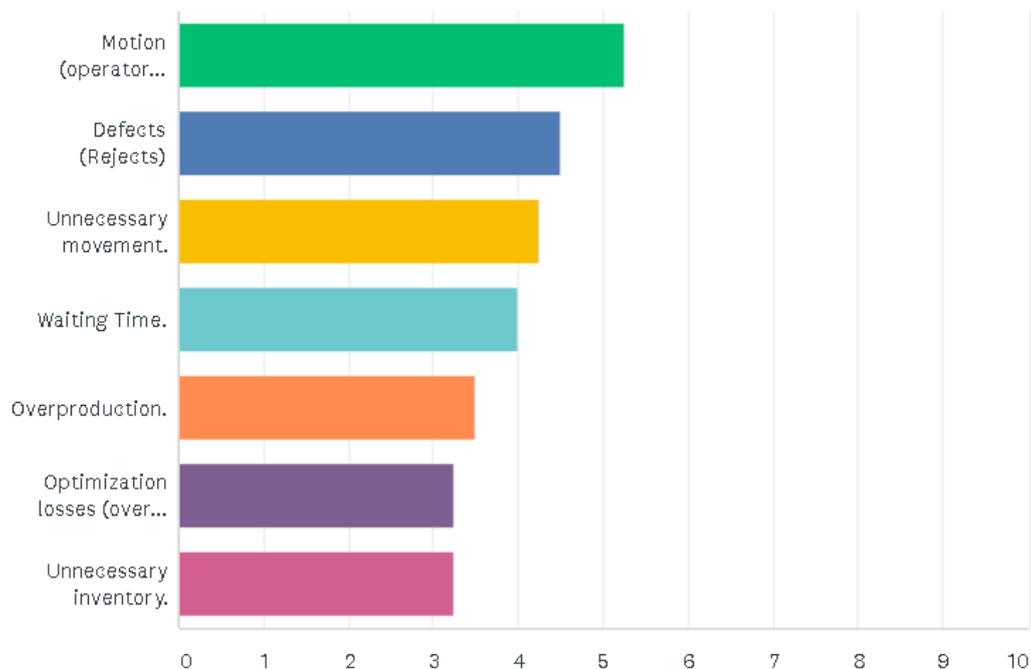
ANSWER CHOICES	RESPONSES
Strongly Disagree	0.00% 0
Disagree	0.00% 0
Neutral/Neither agree nor disagree	50.00% 2
Agree	50.00% 2
Strongly Agree	0.00% 0
<b>TOTAL</b>	<b>4</b>

v. The probability of some related issues.



	VERY UNLIKELY	UNLIKELY	POSSIBLE	LIKELY	VERY LIKELY	TOTAL	WEIGHTED AVERAGE
Lack of quality consciousness	0.00% 0	0.00% 0	25.00% 1	25.00% 1	50.00% 2	4	4.25
Poor communication system.	0.00% 0	0.00% 0	25.00% 1	25.00% 1	50.00% 2	4	4.25
High setup time/changeover time	0.00% 0	0.00% 0	50.00% 2	25.00% 1	25.00% 1	4	3.75
Frequent breakdown	0.00% 0	0.00% 0	75.00% 3	0.00% 0	25.00% 1	4	3.50
Lack of multi-skilled manpower	0.00% 0	25.00% 1	25.00% 1	25.00% 1	25.00% 1	4	3.50
High rejection rate	0.00% 0	0.00% 0	75.00% 3	0.00% 0	25.00% 1	4	3.50
Lack of support from top management.	0.00% 0	0.00% 0	75.00% 3	25.00% 1	0.00% 0	4	3.25
High inventory	25.00% 1	0.00% 0	25.00% 1	25.00% 1	25.00% 1	4	3.25
Frequent design changes.	0.00% 0	0.00% 0	75.00% 3	25.00% 1	0.00% 0	4	3.25
To reduce delivery time.	0.00% 0	25.00% 1	50.00% 2	25.00% 1	0.00% 0	4	3.00
Obsolete technology.	0.00% 0	50.00% 2	50.00% 2	0.00% 0	0.00% 0	4	2.50

vi.Highest and lowest wastes in the company.



	1	2	3	4	5	6	7	TOTAL	SCORE
▼ Motion (operator movement)	50.00% 2	25.00% 1	0.00% 0	0.00% 0	0.00% 0	0.00% 0	25.00% 1	4	5.25
▼ Defects (Rejects)	0.00% 0	50.00% 2	0.00% 0	25.00% 1	0.00% 0	25.00% 1	0.00% 0	4	4.50
▼ Unnecessary movement.	25.00% 1	25.00% 1	0.00% 0	0.00% 0	25.00% 1	0.00% 0	25.00% 1	4	4.25
▼ Waiting Time.	0.00% 0	0.00% 0	25.00% 1	50.00% 2	25.00% 1	0.00% 0	0.00% 0	4	4.00
▼ Overproduction.	0.00% 0	0.00% 0	50.00% 2	0.00% 0	25.00% 1	0.00% 0	25.00% 1	4	3.50
▼ Optimization losses (over process)	25.00% 1	0.00% 0	0.00% 0	0.00% 0	25.00% 1	25.00% 1	25.00% 1	4	3.25
▼ Unnecessary inventory.	0.00% 0	0.00% 0	25.00% 1	25.00% 1	0.00% 0	50.00% 2	0.00% 0	4	3.25

vii. The obstacles to implementing the Lean project.

*“Modernization and development of machinery. Increase awareness among employees”*

*“Lack of the needed time, the unwillingness to change”*

*“N/A”*

*“Nothing”*

## 4.4 Discussion

- 1- It is important to note that the results are discussed in the context that the study aims to experiment the starting up applying of the Lean Manufacturing in the food industry where I work as Quality Coordinator. The experiments are only in two areas roasting and packing excluding other processes like purchasing, design, marketing, and delivery.
- 2- The percentage of wasted time is high 13% in considering that waste is calculated in two departments only of the organization.
- 3- Verifying of the wasted time chart indicates to drop in percentage in parallel activate the production stop report and following up applying the Total Productive Maintenance technique.
- 4- The poor maintenance is the main cause of the time losing. Although after excluding the breakdown of the packing machine No. 2 for 2 months. That assures the huge need to apply and accelerate of applying TPM.
- 5- The list of required maintenance and deficiencies shows that there are 14 tasks affects directly on the productivity and 13 tasks are classified as value-added which are seen by the customers.
- 6- The results of both surveys show the same results about the priorities at applying the Lean manufacturing are the improvement of the quality and customer satisfaction.
- 7- The highest waste is Optimization losses (over process) according to the answers of the external survey, but the internal survey shows the Motion (operator movement) is the highest.
- 8- The lowest waste according to the external survey is waiting time, but the unnecessary inventory in the internal survey.
- 9- The factors of success and fails in the answers to the external survey focus on the human aspect significantly and in the communication between all levels. In addition to that many answers assure the staff motion, quality, planning and management adopting the strategy.
- 10- The employees answer in the organization about the obstacles which face the Lean project differs between no obstacles to the machinery modernization, time management, and the human aspect.
- 11- The internal survey measured some information about the background and environment of the organization. It illustrates that the level of communication, the teamwork, and the familiarity with the Lean philosophy is rather low.
- 12- Lack of quality and poor communication were the two highest wastes as the feedback from Albina Snacks employees. But the Obsolete technology is the lowest waste.

## 5- Conclusion

### 5.1 - Difficulties and Challenges:

The database and statistics about wastage and productivity are not available due to Albina Snacks has been founded only 8 years ago with a small capacity and a small team.

The Organization chart and the leadership system is conventional, all departments and administrators are linked to the director. The conventional structure causes many complexities in a decision making, the information flow and instructions to apply a new system like Lean Manufacturing.

The staff has four different languages, and there is not any language which all employees can simultaneously write or read it. This confuses me and I was enforced to write sometimes some forms and tables three times in three different languages. In addition to that this causes difficulties in the staff communication. The communication in the Lean manufacturing system is essential.

### 5.2- Conclusions

- The theoretical background of the Lean philosophy, in general, gave an idea about the wastes and how to apply the techniques to eliminate the wastes. But in practice, according to Dudbridge, each company is unique especially in the food industry, so it is impossible to copy an experiment from another organization
- In depending on my observations during the study and according to Carreira, the first and most important step that the management adopt the lean philosophy strongly in order to the implantation success, otherwise this will be losing time.
- The metrics and measures, which are missed in Albina Snacks, are the backbones of any lean project. So, it had to begin by creating a core database and start up this somewhere to involve labors in gathering some related information.
- The results of the report of a production stop indicated that percentage of the wasted time in the factory is approximately 13% during the period of study. I believe the percentage is very high. It is noted that the operators don't inform about the waste of time which caused by their mistakes.
- The root cause tool is used to determine the reason for production stop. The results indicate that the poor maintenance is the essential cause to lose time and production stop.
- For above reason, it had to start in applying TPM technique (Total Productive Maintenance) the counting of issues shows that the half of the deficiencies have

a direct impact on the customers and consumers, at the same time they have an impact on the productivity.

- Implementation of TPM should be applied by the production operators, but in Albina snacks, the operators don't have enough experience in the maintenance.
- The poor response from the staff in answering the survey gives negative sign about the difficulty in a potential future implementation.
- Both surveys gave same nearly same feedback about the wastes and priorities.
- The feedback of the internal survey was not promising when this related to the level of teamwork, familiarity with the Lean Production, and the communication

### **5.2.1 Recommendation for future activities**

As lean manufacturing is philosophy, so first of all the management should adopt it and facilitate the application by involving all employees in all levels and departments. The adapting is the most important step to guarantee the success of the Lean implementation.

Upgrade the Organization chart to be more flexible, to reduce leading time, and improve the teamwork and communication in the organization.

Improve the role of the quality concept in the organization from an inspection and documentation role to adopt TQM total quality management.

Raising the qualification of manpower by training.

To apply the Total Productive Maintenance technique effectively, this required involve the operator in a protective maintenance to the machines and making daily and weekly inspection checklist which did by operators.

To continue the implantation of the project many steps should execute

- Classify each process and production step according to a customer point of view i.e. value added to the consumer.
- Draw the layouts of the facility and create the Spaghetti chart in order to redesign the flow chart of the staff and the products in a way to eliminate the wastes.
- Although I decided and mentioned in the project description that the I will 5S technique, unfortunately, I couldn't apply it due to the staff in the experiments area, the workshop and the warehouse, was non-responsive. Now I recommend strongly to apply the 5S tool in the organization.

## 6- Critical Review

The Main Principle of the Lean Philosophy is how to eliminate all type of wastes:

The impact of applying this system should be satisfied form deferent point of view:

**Ethical and Social:** By applying the Lean Production all employees get self-control and monitoring. As the Lean manufacturing give all employees a role in sharing the opinion this increase the democratic values in the organization and the society.

**Economic and Environment:** The wastes elimination this includes time, transportation, inventory, spaces, less energy consumption, less operator motion, less stress, ... etc. these have great positive impacts on the environment and making a great saving in the resources.

**OSH:** The main tool in the lean manufacturing is the 5S technique by applying this system the workplace will be arranged and organized, and a daily housekeeping will be followed. So, the accident possibility will decrease, the working atmosphere will become safer.

- The level of factory personnel's contribution in data collection was relatively low, that affected on the accuracy and reality of results.
- In addition to that the management team didn't sufficiently contribute in answering the internal which also affected negatively on the reality of results.
- Both previous items refer to that the management doesn't still adopt the Lean philosophy.
- The Implantation of TPM technique was performed by the maintenance team, while the correct applying should been performed by machine's operators, but due to the lack of their experience prevented it.
- Two additional techniques (5S and Bottleneck analysis) were planned to apply, but the short period of the study didn't allow to achieve them.
- Both pieces of literature state that the implementation should apply to each employee who must involve in the applying. This requires a good communication vertically and horizontally.
- As mentioned above about the language problem, the communication is limited through a few narrow channels. This issue was a serious constraint during the study.
- Although the student, me, can all languages, it was so difficult to find a creative solution. Maybe it should find a solution out of the box.

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- Dudbridge, M. (2011), Handbook of Lean Manufacturing in the Food Industry, John Wiley & Sons, Incorporated Publications.

# Appendixes

## Appendix 1

 ENJOY THE DIFFERENCE	<b>Production Stop Report</b>
---	-------------------------------

Department:		Stop Time	
Line No./ Mission:		Resume Time	
Date		Stopping Period:	

Reason of production stop
Corrective Action:

Operator Name:

Signature:

## Appendix 2

	Document name <b>Deviation Report</b>
---	--

<b>Date:</b>	<b>Report No.</b>	<b>Department:</b>

<b>Deviation</b>			
<b>Corrective Action:</b>			
•			
<b>Date of decision:</b>	<b>Responsible:</b>	<b>Target date</b>	<b>Done and approved (date and signature.)</b>

<b>Root Cause</b>			
•			
<b>Preventive Action:</b>			
<b>Date of decision:</b>	<b>Responsible:</b>	<b>Target date</b>	<b>Done and approved (Date and signature.)</b>

<b>Quality Manager:</b>
-------------------------



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