SAVONIA

STUDY AND OPTIMIZATION OF FLOW PACKING UNIT

Case: Famifarm Oy, Finland

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Bachelor's Thesis

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Valitse kohde.

SAVONIA UNIVERSITY OF APPLIED SCIENCES **THESIS**
Abstract

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Abstract

This study is based on the development policy of the case company. The vision of the study was to understand the systems and processes involved in the flow packing unit, to find the performance barriers and to suggest possible solutions to increase the efficiency of the unit.

The data for theoretical study was collected from books, lectures and internet. Theoretical data collection was focused on process management, resource management and analysis methods.

The empirical data collection is based on company's systems and processes. One part of empirical data was collected by interviewing company personnel and one to one sessions with workers, while other part was collected by quantitative data collection method for which a data collection form was designed. Qualitative data collection was used to gather the information regarding company's processes for resource and quality management and to understand the worker's knowledge about work. Quantitative data analysis was used to find the efficiency and problems of the technical side of the system. The major part of the information was gathered by observation and self-participation of the researcher in the actual system.

The study was divided into two main parts. In the first phase all the existing systems and processes in the company were studied while in second phase the collected information was analyzed, problems in systems and processes were found out and possible solutions were generated.

Study will help the case company to make positive changes in the production process of flow packing unit and also other companies in this business sector.

Keywords
Flow packing , Process management , Benchmarking , Conveyor , Standard operating procedures

CONTENT LIST

APPENDICES

1 INTRODUCTION

1.1 Research background

There is a general concept that research and development is related to the invention of new products, services or processes, while the case is not exactly this, as development of existing products or services is also very important because customer's preferences change with the time period and a company need to modify its products, services and systems according to the change.

It's not enough for the companies to just stay with competition nowadays, they need to get ahead whenever possible. Companies in today's business environment face a continuous challenge to manage the change in order to enhance their revenue, to increase customer satisfaction, to reduce the waste and use their resources at the best. Managers need to optimize business processes at various stages during manufacturing process. Due to vibrant environment of competition this optimization should at least be frequent if not continuous.

Famifarm Oy is a leading green house in Finland. The company has captured a big part of market in its business sector. To maintain its position in the market, company need to keep an eye on its production process. The market demand for certain products is increasing and company is interested in optimization of its production system.

This research study is based on continues development policy of the company. Flow packing unit is one of the main parts of production system of the company, and this research will concentrate on detail study of flow production system to find out performance barrier and room for improvement.

1.2 Objectives of the study and the research problem

The study was initiated as a result of researcher's interest towards process management systems. Study was aimed to understand the systems and processes involved in flow packing unit of the case company. It was important to get the knowhow of the unit deeply in order to find the performance barriers in the system. Study was also result of company's continuous development plan and interest in optimization of production department.

Optimization of flow production system is the subject area for the thesis. The objective of the paper was to research on the complete flow packing system in production department of the case company, to check of its current performance level and to understand the factors involved in reducing the efficiency. Some of the main products of the company are packed in flow packing unit. In last few years company has automated major parts of flow packing unit in order to increase its efficiency in quality and quantity sector.

In an interview with the company's head the author explored that company has invested big resources over the unit and it has been modified in large scale in order to increase production capacity and efficiency of flow packing unit, but even after that there is not visible change in efficiency. Company wants to explore out the new and cost effective ways to make this system more efficient.

In the research every part of flow packing unit is studied. Different data collection methods are used in order to get detailed knowledge of systems and processes used in this unit. All the data is compiled and observed deeply in order to find out the performance barriers.

1.3 Methodology and research tools

”Research is a process of expanding the boundaries of our ignorance”. (Goddard and Melville 2007, 1)
Research methodology is actually a way to know that what a researcher is going to do in his/her research. Research methodology helps the researcher to plan the things according to its requirement and streamline research according to the research type.
From selection of the research topic to conclusion, research methodology guides researcher to keep involved in the field of enquiry. Plan of action can be set on the right track only by choosing the right methodology for the research.

In this research paper both qualitative and quantitative methods are used for data collection. Qualitative data is collected by doing interviews with some of the company personnel. Interviews were based to understand company’s expectations from the flow production system and to get knowledge of resource management system and quality management system in the specific unit.

Quantitative data is collected by designing a data collection sheet (Appendix 3) to observe the factors affecting the efficiency of flow packing machine and conveyor line. Most of the study is done by self-participation in the actual production system in order to understand every part of the system and process deeply. Researcher has used almost two months as an active participant in the production unit.

2 FLOW PRODUCTION AT FAMIFARM OY

2.1 Järvikylä and Famifarm Oy

Järvikylä is one of the oldest manor houses in Joroinen. The manor has been owned by Grotenfelt family from the very beginning. Grotenfelt family has a major influence on Joroinen from the late 17th century. Järvikylä has been a pioneer in development of dairy farming and agriculture. (joroistenmusiikkipaivat 2012).

Famifarm is the dominant company of greenhouse production in Finland. It has two greenhouses located in Joroinen, Juva and a contract grower Turakkala Oy located in Juva. The greenhouse located in Joroinen is the biggest (main) planting and production set up by the company. Famifarm Oy produces vegetables and herbs in the greenhouses which are packed in different packaging systems. Products are sold under the brand Järvikylä, which is known as the market leader in the greenhouse farming in Finland.

Figure 1. Brand logo of Famifarm (Jarvikyla 2012)

Customers of Järvikylä include household consumers, retail sector, HoReCa sector (Hotels, Restaurants and Catering) and industry. Most of the company products are sold in the domestic market and a small portion is exported to Estonia. There are about 120 people working in Joroinen (Järvikylä) green house. For the green

house in Juva, there is staff of 10 people both for production and services. Furthermore, the Marketing Division is located in Helsinki. The production capacity of the greenhouse in Joroinen is summarized in the Table 1.

Table 1. Production capacity of Järvikylä greenhouse Joroinen. (Mustafa 2011, 5)

Total Area of Greenhouse	4.9 hectors
Number of Production Houses	9
Number of Production Lines	20
Number of Gutters (Kourut)	15 516
Plants	1 250 290

The products grown at Turakkala Oy greenhouses on a subcontract basis include a variety of Herbs as Basilika, Sitruunabasilika, Thai-Basilika, Kanelibasilika, Punainen Basilika, Herneenverso, Auringonkukanverso, Korianteri, Kynteli, Kirveli, Rosmariini, Rakuuna, Minttu, Vesikrassi, Salvia, Timjami, Meirami, Oregano, Sitruunamelissa, Lipstikka, Perilla, Vehnänoras, Mizuna Salaatti, Viinisuolaheinä, Lehtipersilja, Basilika Iso, Timjami Iso, Rosmariini Iso, Laventeli Iso, Viinisuolaheinä Iso, Sinappi and Lehtisinappi . Some of the Järvikylä brand products are shown in figures below. (Mustafa 2011, 6)

Figure 2 shows Lettuces & herbs which are partially grown in Joroinen green house while partially by other growing partner. All of these products either grown in Joroinen or other green houses are finally complied and dispatched from main greenhouse dispatch center in Joroinen.

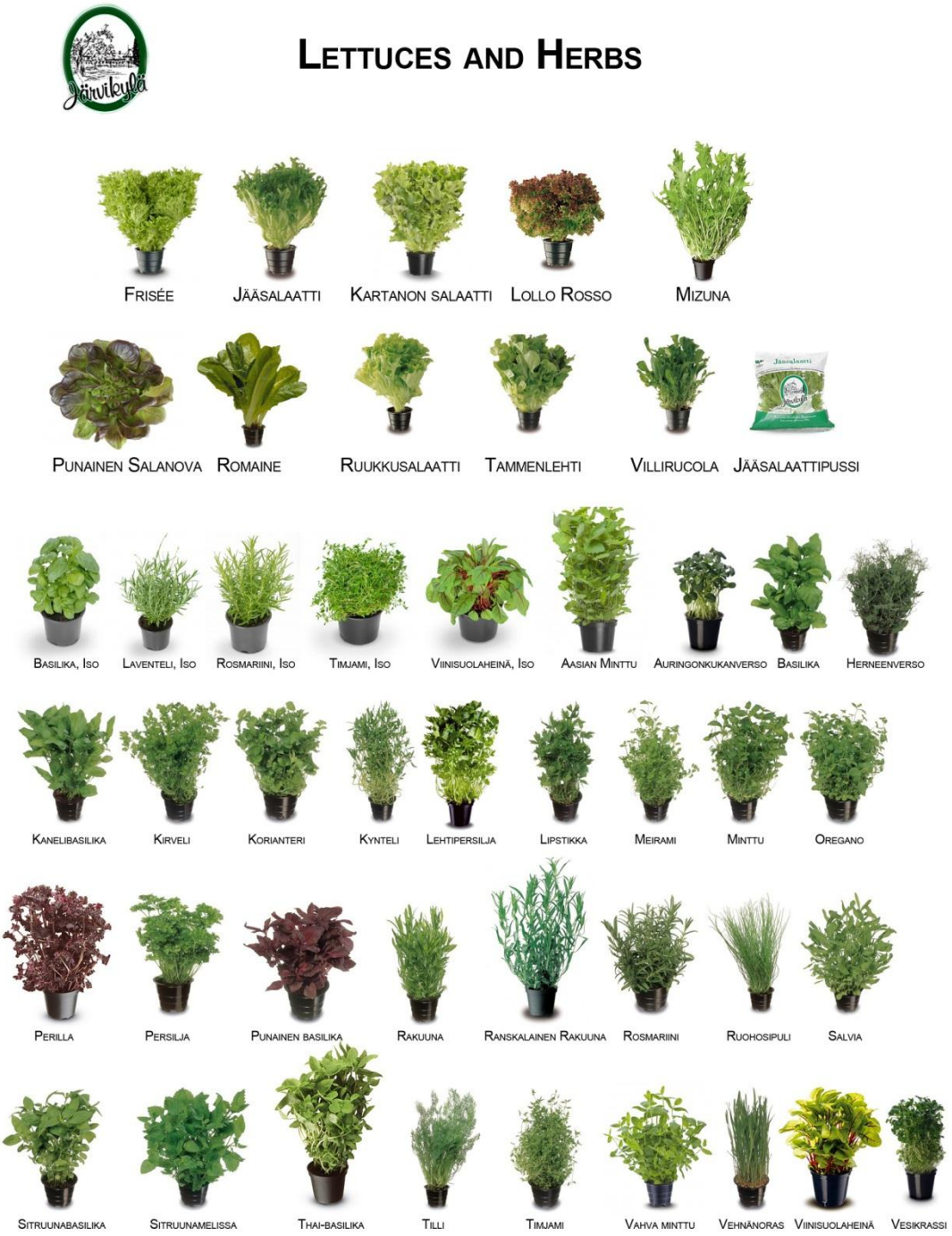

Figure 2. Herbs grown under Järvikylä brand (Jarvikyla 2012)

2.2 Flow production

Flow production is also called mass production. In this kind of production system, many production operations are organized is such a way that they are carried out one by one. These operations are designed in such a continuous sequence that they are connected with each other ending in producing the required product. (Leone and Rahn 2002, 17)

Flow production system helps the manufacturer to design a system which can produce different kinds of products at one time. It is a time efficient system which reduces delays in manufacturing process. It enables manufacturer to improve quality and productivity. It also leads to a better floor space management, inventory and waste reductions.

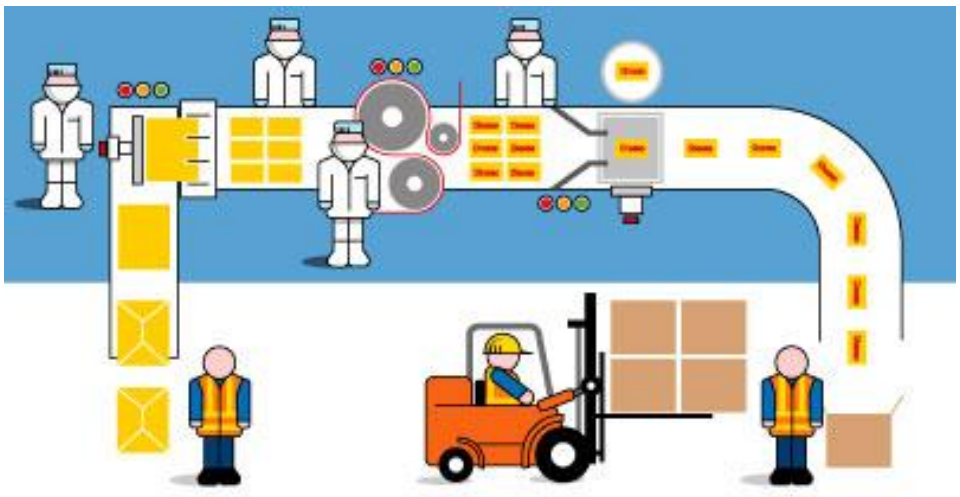

Figure 3. Flow production (Santisinternational 2012)

Manufacturer can adjust the rate of production by adding or removing resources from the production line. It provides flexibility in changing the output rate without making changes in physical design of the production line

There are several other benefits for which companies like flow production. For example:

- On time delivery of products
- High quality
- Low operating cost

- Error proof work process
- Systematically focused work
- Shortened manufacturing lead time
- Better resource utilization
- Better reporting and follow-up

Famifarm is using flow production system in almost most of its production department, but two products “Ice lettuce and Frisee bag” are specifically packed in a well-designed flow packing system. These two products are packed as “Industrial food products”, therefore a special cutting and packing system is designed for them.

There is a dedicated conveyer line installed for transporting the cut products from growing rooms to packing room. The conveyor line is fully automated and occupied with special cleaning system to maintain the hygienic conditions. It’s integrated with a flow packing machine which is installed in a special packing room. This room is equipped with all the necessary equipment required to meet the demands for industrial food packing.
Figure 4 shows the steps of actual packing processes in flow packing unit of Famifarm Oy.

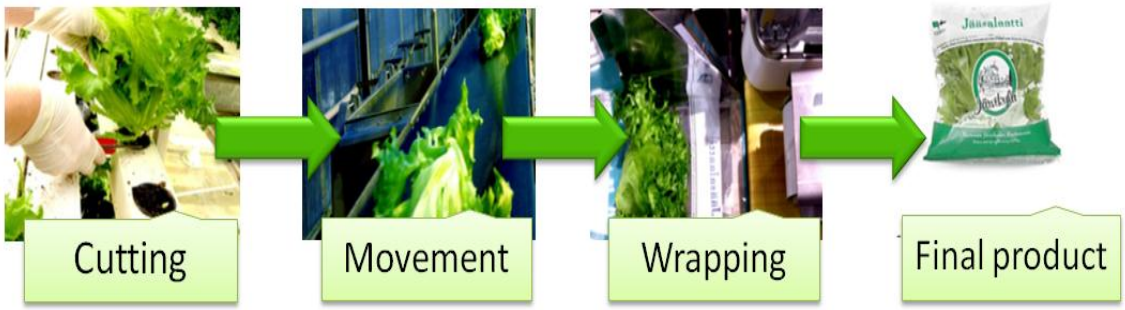

Figure 4: Actual packing process at flow packing unit in Famifarm, Joroinen

2.3 Processes in flow packing unit

Flow packing is organized very systematically in Famifarm. All the processes are linked in a continuous chain to make it an efficient system. Packing is done in two shifts, while most of work is done in first eight hours. There are three teams designed to work in different areas of production system. “Team 1” is trained to work in production area where flow packing system is installed.

2.3.1 Resource management

Resource management or resource planning can be explained as a forecast to know how many and what kind of employees is required for certain kind of job. It depends on kind of demand that is needed to be fulfilled. An effective resource management leads to right people doing right things in right place at precisely right time. (Graham & Bennet 1998, 163)

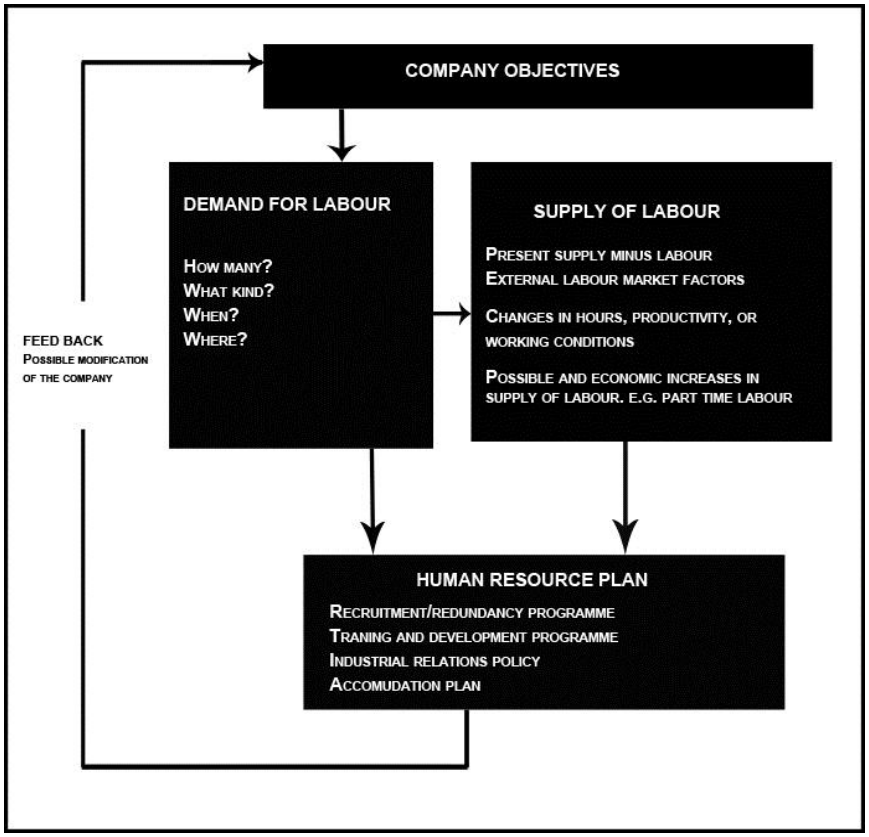

Figure 5. Human resource planning process (Graham & Bennet 1998, 164)

Famifarm has two types of workers in production department, permanent workers and part time workers. There is specific number of permanent workers which are hired according to the basic work demand in order to keep the product cycle running. Part time workers are hired to fulfill the demand of absent workers or extra work. As company is expanding every year also number of workers keeps on changing as per requirement.

Famifarm has designed a system in which they need to keep their product cycle running whole year round. This is very necessary in a green house in order to make sure fresh supply of its products. Also there is standard size and weight of products which needs this cycle to be running without interruption. As the life of the plants grown in a greenhouse is very short, so it is not possible to stock a lot of product in warehouses. Also it is not easy to forecast the exact demand of product in the market as it differs with occasions, weather and certain other factors.

Workers in Famifarm are managed according to their product cycle. Production cycle in Famifarm can be explained by Figure 6.

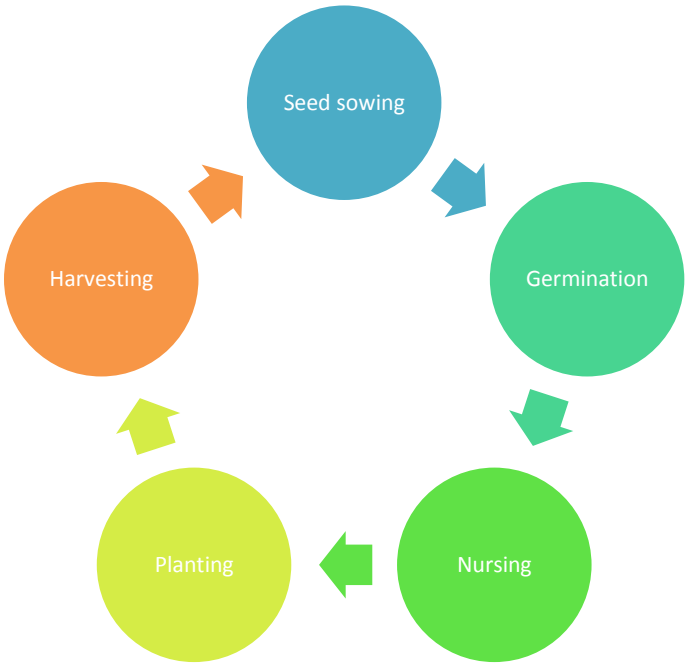

Figure 6. Plants production cycle at Famifarm Oy

Harvesting is the last stage when plant is ready to be packed. The flow packing process starts at harvesting and resource are assigned on both ends of the system. Resource management in flow packing unit entirely depends on following factors:

- **Product size**

  The products are packed at a standard weight which is affected by size of the plant, therefore the size of plant is very important at harvesting time. If plant is too small, it will not meet the minimum size required to be packed, while if plant size is too big it cannot be packed into the standard sized packing bags. So number of people is assigned on depending how many rooms have reached the standard size of harvesting. This is normally done by checking the product size in every room one day before harvesting and resources are managed accordingly. It also depends on how many people can reach the required number of harvesting in certain shift. (Soininen, interview, November 2012)

- **Product quality**

  Product quality is also a factor that effect resource management in Flow packing unit. There are several factors which can affect the quality of a growing plant in greenhouse. Company's standards towards product quality are high therefore it is made sure that only the product with standard quality can reach the market. Plant's health is checked one day before the harvesting and depending on the quality it is decided that how many number of people should be managed on the cutting line. (Soininen, interview, November 2012)

- **Product demand**

  Demand for the products keeps on changing and it depends upon weather change, occasions and some other factors. Although there is a specific product cycle followed for harvesting but the increase in demand effects the resource management in flow packing unit. In case of increase in demand

the number of resources on cutting lines is increased and to balance the workload additional helping hands are also provided in the flow packing room. (Soininen, interview, November 2012)

2.3.2 Standard operating procedures

Standard operating procedure is a process to implement the company policy. Standard operating procedures answer four main questions under company policy. Those for main questions are

- What?
  What is necessary for the tasks to be done? For example resources, material, equipment etc.
- When?
  When the task will start or finish? For example time, date, period etc.
- Where?
  Where will the required task to be done? For example: place, area, department etc.
- How?
  How the task will be done? For example: Skills, Training, Steps etc.

  (Overview of SOPs 2012)

The details in standard operating procedures standardize the process and provide step by step instructions that enable anyone within operating environment to perform a task in a consistent manner. The step by step written procedure can also help hold employees accountable because employee expectations are documented and their actions can be measured against the standard operating procedures.
(Overview of SOPs 2012)

There is a printed handbook for standard operating procedures for production department of Famifarm. Operating procedures are defined in details for every unit and working regulations are made separately for packing and cutting lines. In Figures 7 & 8 are the details of currently followed operating procedures and working regulations in flow packing unit.

Ice lettuce

Cut in a bag

Size

- minimum weight 100 g

Preparation for market

- remove yellow, brown and damaged leaves
- rip the roots shorter if they can reach the lettuce
- If the plant grows a stem, cut the stem near its' growth point
- tip burn (black or brown in tips of the leaves or edges, can appear also as 'inner black' in growing points) will be picked off unless plants' appearance is damaged
- foreign species or objects must be removed if that is possible without damaging the plant
- small products will be put into green plastic boxes for packing two at a time

Throwing away the product

- first contact the foreman if there is plenty of products that need to be thrown away
- plants with pests
- plants with bird droppings
- plants with foreign species or objects if it is not possible to remove them without damaging the plant
- plants with 'wild' species
- plants which are too small, too big or too thin, *only when two products' combined weight is under 100g*
- plants with so many bad leaves (brown, yellow, damaged, tip burned) that it is not possible to remove them without damaging the plant

Other reminders

- take care of the hygiene (hygiene practices)
- assort the waste (biowaste and garbage)
- clean up after you are finished
- Plant damages very easily because of its' crispy structure: handle the plant carefully by grabbing it from the pot or lower part of the plant

Figure 7. Working regulations in flow packing in Famifarm Oy (Introduction guide for new employees)

Frisée

Cut in a bag

Size

- minimum weight 100 g

Preparation for market

- remove yellow, brown and damaged leaves
- rip the roots shorter if they can reach the lettuce
- If the plant grows a stem, cut the stem near its' growth point
- tip burn (black or brown in tips of the leaves or edges, can appear also as 'inner black' in growing points) will be picked off unless plants' appearance is damaged
- foreign species or objects must be removed if that is possible without damaging the plant
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Other reminders

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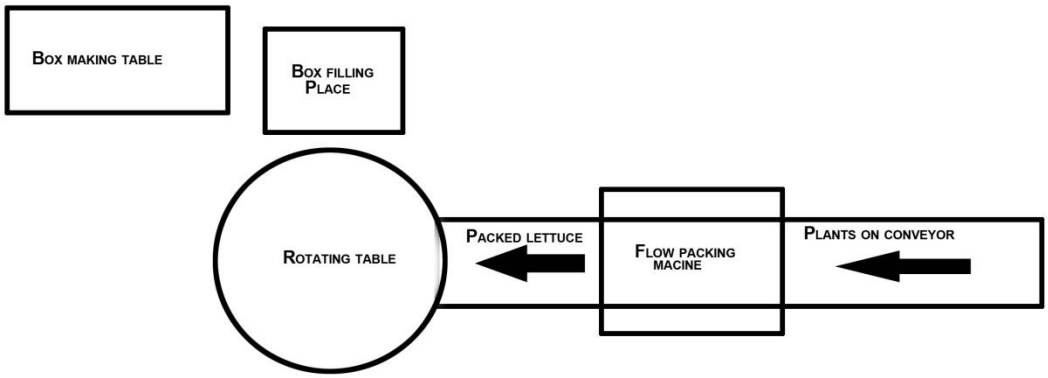
- assort the waste (biowaste and garbage)
- clean up after you are finished

Figure 8. Working regulations in flow packing in Famifarm Oy (Introduction guide for new employees)

SOPs FOR FLOW PACKING

Horizontal Flow Pack Machine Unit (Figure) is dedicated for the packing of Jääsalaatti. During harvesting process, the plants are cut manually, put into the baskets that are arranged on a wooden pallet and transferred to the flow pack machine unit through manual transportation. Cut plants are removed from the baskets and transferred to the conveyor belt of the machine and packed and sealed in plastic bags automatically. The box making and putting the packed plants into the boxes is done manually. Room temperature is kept at +6 to +8C.



Working Details

Number of workers required:	Normally 05
Level of skills required:	Medium to High
Equipment and Supplies:	Products coming from production line
	Packing Sheet
	Wooden pallets and jack machine
	Paper board sheets

Figure 9. Standard operating procedures for flow packing room (Introduction guide for new employees)

These standard operating procedures and working guide books are given to the new joining workers. There are also team meetings organized to update the workers about any changes in working procedures and organization. There have been installations of new conveyor lines and systems in the flow packing unit, which are unfortunately not updated in the guides yet.

2.3.3 Quality management

In every production system there is a need of certain quality management system to meet the company's standards defined for customer satisfaction. Generally there are two approaches used for this purpose:

- Quality control

  This is the process of maintaining quality by dedicated inspection team or person. There are random or specific checks made through the batch of products manufactured. Mostly individuals are not encouraged to check the quality of products they produce. It is the responsibility of quality inspectors that no faulty product reaches the customer. This system mostly focuses on outputs and finished products.

  (Production quality management 2012)

- Quality Assurance

  Quality assurance is long term and detailed process which is not specified to any person or team. In quality assurance system every worker is responsible for the quality of his or her work. The quality checking begins from the start the production process and is done on every level by the person doing his work. This kind of system creates a quality control culture, where every worker feels its responsibility to make sure that the right product is reaching the customer.

  (Production quality management 2012)

In Famifarm flow packing process can be categorized into four steps in Figure 10.

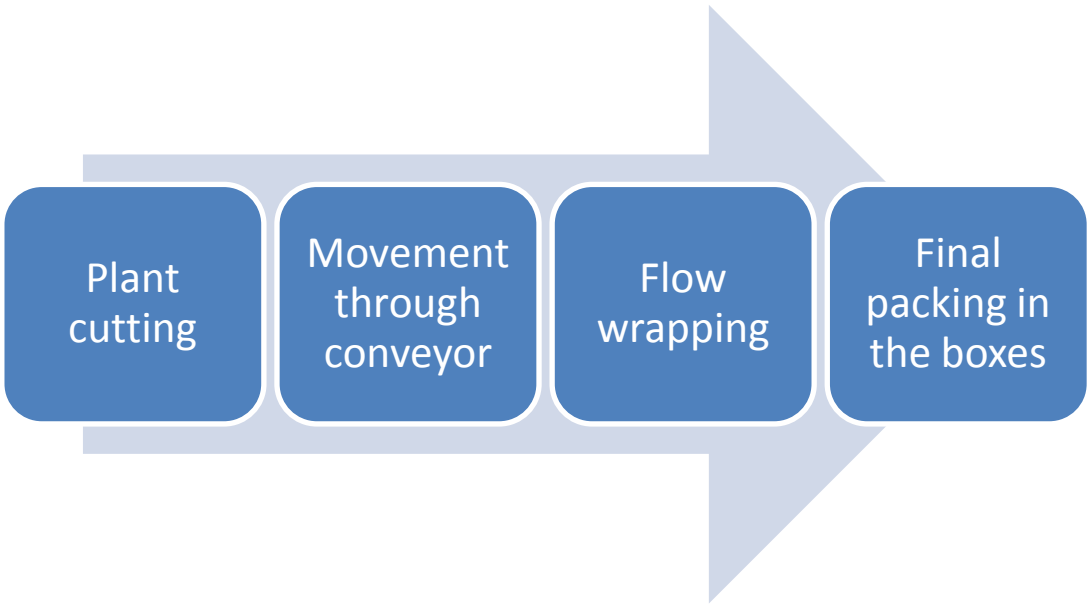


Figure 10. Steps of flow packing process in Famifarm Oy

- Plants cutting
- Movement through conveyor
- Flow wrapping
- Final packing the boxes

Quality management is normally done by quality assurance method in flow packing unit. Quality is checked almost at all the four steps in order to make it sure that the right product is being sent to the delivery room and customers.

- In cutting rooms every worker who is cutting the plants is responsible for checking the quality of the product, and is made sure that the desired quality should be placed on the conveyor line.
- During the movement of product over the conveyor line, it's the responsibility of team leaders to check the products randomly.
- When product reaches the final packing room, its checked again before moving it to the flow wrapping machine. In the end product and packing quality is also checked before final packing in the boxes.

Fami farm is also certified by UKAS Management Company according to ISO 9001:2009 standard.

Figure 11. Quality certificate (Picture from company's original certificate)

3 KEY PROCESSES AT FAMIFARM OY

In a true business process inputs of all types are converted into outputs. This transformation occurs according to process guidance, such as policies, standards, procedures, rules and individual knowledge. (Burlton 2001, 72)

The steps in a business process are very important as there can be some illogical steps which can delay or complicate a process, for which it is very important to keep the processes optimized.

3.1 Production process

Every business is in the market in order to give some services or products. Products and services can be made available by converting inputs to outputs. The process involved in the conversion of inputs to outputs is called production process. (Production process 2012)

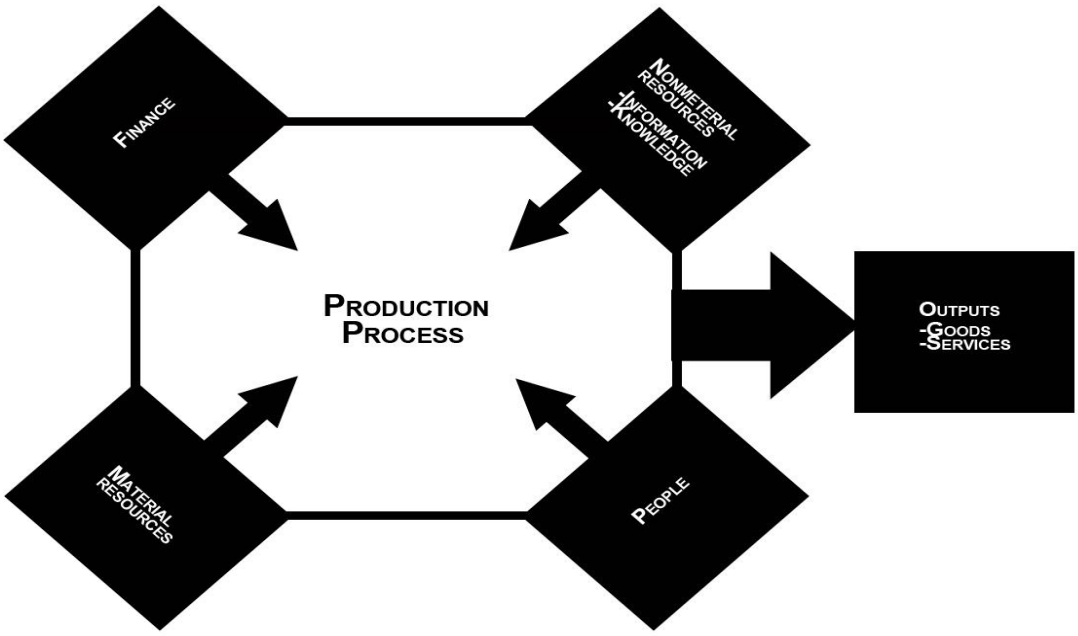


Figure 12. Production process (Managementmania 2012)

Figure 12 shows that the production process is ensuring that all the factors in production unit are synchronized to deliver the performance. The transformation of inputs into outputs is aligned with the desired results.

3.2 Process management

Process management is itself a process that is used for continued improvement in a company's performance. (Burlton 2001, 73)

Processes are the best way to measure an organization's performance. If an organization is bigger in size then it's better to define processes according to the specific department. In a production department of a company processes are as important as other assets of the company like, people, facilities, machinery etc. Processes work as in interface to connect all these assets in a proper way to get desired outputs. (Burlton 2001, 74)

Production is required to be more efficient in today's competitive environment but there cannot be compromise on customer satisfaction in terms of quality and quantity. Sometimes the organizations face high production cost because of number of steps involved in flow production process or the steps are not synchronized in the right sequence in term of place and time. Therefore the process management is done to review the process steps and find out the performance barriers in it.

Flow packing unit of Famifarm comprises many steps which are synchronized to each other. Figure 13 shows how the inputs are processed to outputs in flow packing unit of Famifarm Oy.

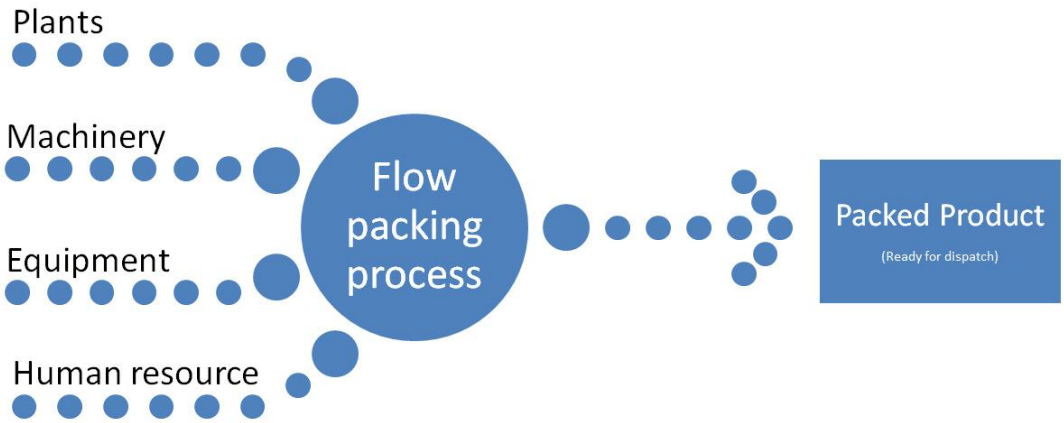


Figure 13. Flow packing process at Famifarm Oy

All the inputs are connected in a specially designed flow packing process which leads to a required output. The process was made when the setup for this unit was initially installed and was properly documented. The demand of the product increased with the passage of time and there were several modifications made in the flow packing unit. New machines and lines were installed, new techniques are used but unfortunately the packing unit was not able to give the desired results there was a need of optimization of processes.

3.3 Benchmarking

Benchmarking is the process of comparing and measuring an organization against others, anywhere in the world to gain information on practices and measures that help an organization take action to improve its performance.
(Coers, Gardner, Raybourn and Higgins 2002, 1)

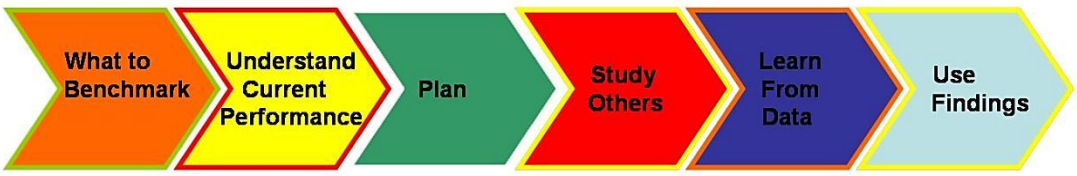


Figure 14. Benchmarking (wordpress.com)

There are many types of benchmarking:

- Performance benchmarking
  Performance benchmarking is a process of comparing own company with another company in order to check how well is our company from others. (Andersen & Pettersen 1996, 5)

- Process benchmarking
  Process benchmarking is comparison of practices and methods. It is used of compare one's own business processes with best for improvement. (Andersen & Pettersen 1996, 5)

- Strategic benchmarking
  Strategic benchmarking is comparison of the strategic choices made by other companies with own company to improve the strategic structure. (Andersen & Pettersen 1996, 5)

As per "World Greenhouse Statistics" there are 1490 greenhouse products producing companies. There is a local benchmarking process developed on a small level in Famifarm, but there is a big room for improvement for which company can design a process of benchmarking for many international companies. Famifarm is a domestic as well as international supplier of greenhouse products and it is very important for the company to keep it updated with the new practices and processes followed internationally in this business sector.

3.4 Problem solving

Problem solving is a process that has an arrangement of different sections combined together to solve the type of problem. These sections are displayed in Figure 15.

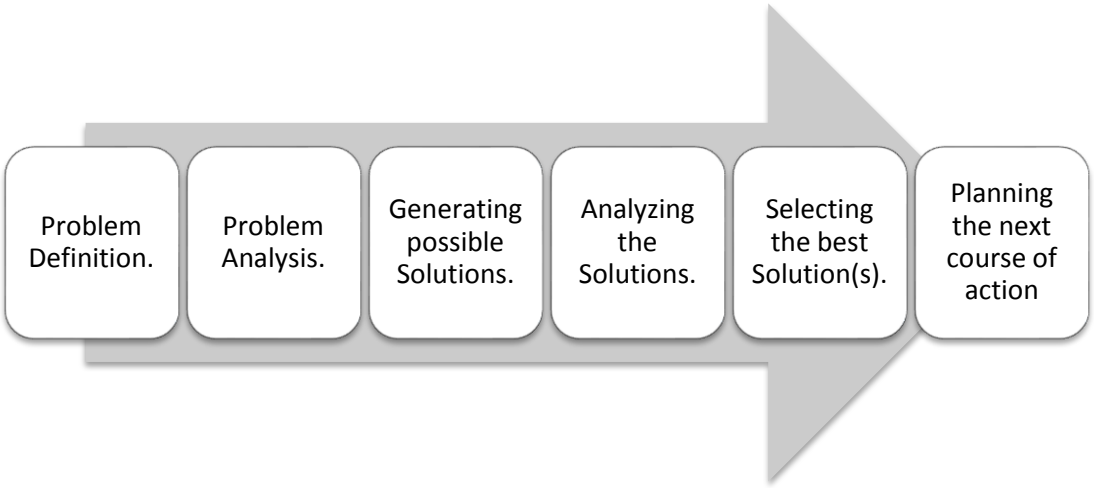


Figure 15. Sections in problem solving (www.gdrc.org)

The approach of problem solving seems to be the closest to the process of development in Famifarm. This research was initiated on the bases of problems related to performance of flow packing unit of the company. First of all the problem was identified by the top management of the company. Company has applied all the possible resources and equipment to increase the productivity of the flow packing unit but unfortunately the output results were not as per expectations. A research was then initiated to analyze the depth of problem and to generate possible solutions to solve it. The solutions are then presented to the top management of the company. Management analyzed the solutions and selected the best possible ones for implementation.

4 PERFORMANCE ANALYSIS

Performance analysis is an approach to check the efficiency of a system or process. There are two types of analysis approached used to check the actual performance level of the flow packing unit.

4.1 Qualitative analysis on resources and communication

Qualitative research is collecting, analyzing and interpretation of data by observing what people do and say. Qualitative research refers to meanings, concepts, definitions and description of things. (www.icoe.org)

There were two methods used to complete the qualitative research.

- Interviews with management

  An interview was conducted with operations managers in order to understand the resource and quality management systems followed at Famifarm.
- One to one sessions with employees of flow packing unit

  During on hand training, a small list of questions was asked from 5 employees working in flow packing system.

Researcher was given a possibility to work in the flow packing unit to get know how of the system. Following sections were covered to analyze the qualitative part of the flow production unit:

- Resource knowledge
- Resource allocation
- Information communication.

Figure 16. Areas of qualitative analysis in Famifarm

4.1.1 Resource Knowledge

Knowledge of workers related to specific job is an essential tool to get the job done correctly. In a flow production system, worker on every step of the process need to have enough knowledge of the job they are doing, as every step in synchronized with the next step. A problem at one step can affect the whole flow production process.

First the researcher read the entire standard operating procedures and working regulation for flow packing unit. Then researcher understood the system by getting hand on experience on the actual system. Researcher also worked on the cutting lines and final packing room. An interview was organized with the operations manager of production department in order to get the knowledge of the process that how Famifarm provides trainings and updates its workers regarding their work in flow packing unit.

There are mainly two sides of the unit in which human resource is used.

- Cutting side
- Packing side.

Cutting side is basically the starting point of the process where plants are cut, cleaned and placed on the conveyor line. There are special instructions mentioned

in “workers guide” about cutting and cleaning the plants. In one to one session with workers on the cutting line, it was observed by researcher that not every worker is aware of the standards mentioned on workers guide. Also there was difference in opinions of workers regarding working procedures, due to which there was not one standard procedure followed by all of the workers. This difference in knowledge level of workers is leading to three performance barriers shown in Figure 17.

Figure 17. Negative effects of incomplete resource knowledge

- Product quality is affected by incomplete or incorrect information. There is a standard procedure of cutting and quality check of the product. This procedure is updated with the time depending on change in company policies. Because of inefficient communication process, the information to the workers is either not completely delivered or not delivered on time. This inefficiency affects the quality of work which ultimately leads to product quality issues.
- There are different working procedures guided to workers about product wastage depending upon quality, demand and other factors. If a worker is not updated about the current followed procedure, there can be surplus waste of products.
- Packing system needs a process to be followed from cutting lines to packing machines. If any of the information is missing on any end, it effects the continuous operation of the system.

4.1.2 Resource allocation

Resource allocation means putting right people and right number of people on specific workplace. As it's mentioned above there are two sides of the flow packing process where human resource is used. There are two different resource allocation methods used for them.

- **Cutting lines**

  There are mainly four cutting lines directly connected and one cutting line indirectly connected to the conveyor belt which takes the product from cutting lines to packing room. Allocation of workers on cutting lines is based on three main factors related to plants.

  1. Size
  2. Quality
  3. Demand

     There is a standard plant size at which the plant reaches the required weight. All the cutting lines with standard size need to be harvested in time in order to keep the product cycle running. As the growth of the plants depend on many factors, so there can be difference in growth timing of different lines. To get information about which and how many lines are ready to be cultivated, there is a regular checking process done every day, according to which resources are allocated on the cutting lines and lists are generated. During on hand trainings the researcher observed that some times the number of people working on cutting lines was either more or less than required. In both cases the efficiency of the system was getting affected as described in Figure 18.

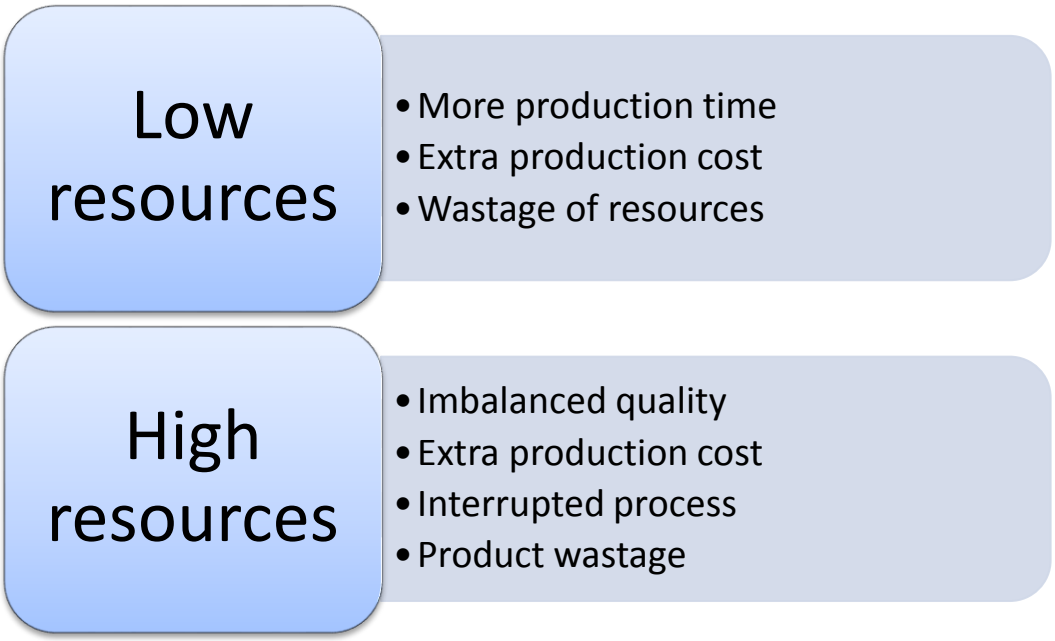


Figure 18. Effects of resource allocation on production system in Famifarm

- **Packing room**

Packing room is the ending point of the flow packing unit. There is standard number of people allocated in packing room every day. There is no change in number of workers made on regular basis. Workers allocated in packing are trained to work on special machines. Workers are required to keep on their special outfits provided, as there is low temperature maintained in the packing room. Due to complex machines only specified skilled workers are allowed to work in packing room. Safety and hygiene rules are properly maintained in packing room to keep the product quality maintained. Resource allocation on cutting lines directly affects the performance of workers in packing room.

4.1.3 Information communication

Information communication is one of the most important parts of a process. Right and in time communication of the information is very important to keep a process work smoothly. There are two main processes by which information is communicated to the workers

- Team meetings
- Team leaders.

There are on and off team meetings organized by the company to updates the teams about new rules and regulations. On one hand these team meetings are very effective as information is communicated to most of the workers at the same time, but on the other hand it is not possible that all the workers are present at those team meetings. Team leaders are also a way to provide information to the workers but still it seems that both of the systems are not efficient enough to take all the workers of the flow packing unit at one level. As all the workers have difference in level of information, this lead to an interrupted process.

There is a need to design an effective information communication system through which all the new and old information can easily be accessible to the workers, so all the workers can have maximum level of updated information regarding systems and processes. There are also several basic instructions which need to be placed on different places in order to keep the production process smooth.

4.2 Quantitative analysis on flow packing machine performance

Quantitative analysis is to answer the questions about relationships among measured variables with purpose of explaining, predicting and controlling phenomenon. (Savolainen 2008, 20)
Quantitative research is reliable and objective oriented. The details in this type of research are less but more accurate.

Quantitative research method was used to measure the performance of flow packing machine used in packing. This machine is directly connected to conveyor coming from the cutting lines. Efficiency of whole unit is also dependent on the performance of this machine.

Famifarm is using one of the best flow packing machines in its category. The machine is capable of packing 10 to 120 packets per minute. Machine is directly connected to the conveyor line coming from the cutting rooms. Company is facing interruption in flow packing which is causing the machine to stop many times in a working day. There are several factors involved in effecting the performance of machine, which ultimately lead to efficiency of whole flow packing unit.

A data collection form was designed in order to find out the reasons because of which the packing system gets interrupted and machine stops. Researcher used twenty days to collects the data by working in the flow packing room and observing the machine. Data collection was done in the morning shift from 6:00 am to 1:30 pm. There was a continuous interruption in machine performance because of several repeated reasons. These reasons were observed during work in the packing room. Reasons were listed in the data collection sheet (Appendix 3) and marked as per frequency and interval.

There were 12 difference reasons found which were affecting the continuity of flow packing unit. List of the reasons is given in Table 2.

Table 2. Reasons of interruption of flow packing process

1	Lettuces too close or trash leaves
2	Lettuce size
3	Lettuce quality
4	Packing paper stuck
5	Packets stuck in the end
6	Printer not working
7	Printer change
8	Packing paper roll change
9	Weight machine
10	Too much to pack in tray
11	Box machine
12	other

These were almost all those factors because of which the continuity of the flow packing was getting interrupted. This was also affecting the loss of resources, risk on product quality and underuse of machine capacity.

- Interruption effects

  Researcher observed the packing system for almost 127 working hours. Due to different reasons the packing system was getting interrupted. Data evaluation is shown in the Figure 19.

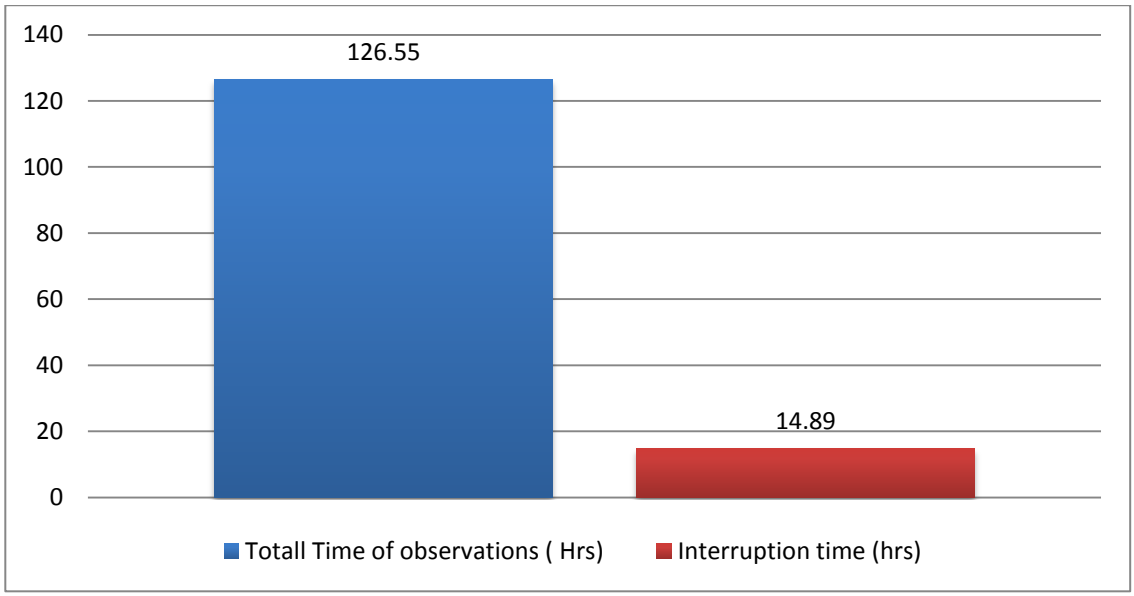


Figure 19. Interruptions in flow packing system

The graph shows that out of 127 working hours, packing system actually kept working for 111 hours. There was an interruption of 15 hours, leading to 12 % loss of production time. In normal routine there are around 6 workers over the cutting lines while 3 workers in the packing room. It can be seen that for 15 hours 9 workers were doing nothing, also the work that was supposed to be done in those 15 hours will take extra time. The production cost will ultimately increase, resources will be wasted and there will be negative affect on the profit level of the company.

- Factors

  There were many factors causing interruption as mentioned in the Figures 20 and 21. It was very important to find out the most effecting factors which

needed to be optimized in order to increase the efficiency of the system. Data was analyzed in terms of frequency and time, and the results are shown in the Figures 20 and 21.

Figure 20 shows how many times a specific reason is creating an interruption in the continuity of the system while Figure 21 shows the effects in terms of time and which factor is holding the system longer. It was really important to highlight those reasons which were directly affecting the efficiency of the packing system.

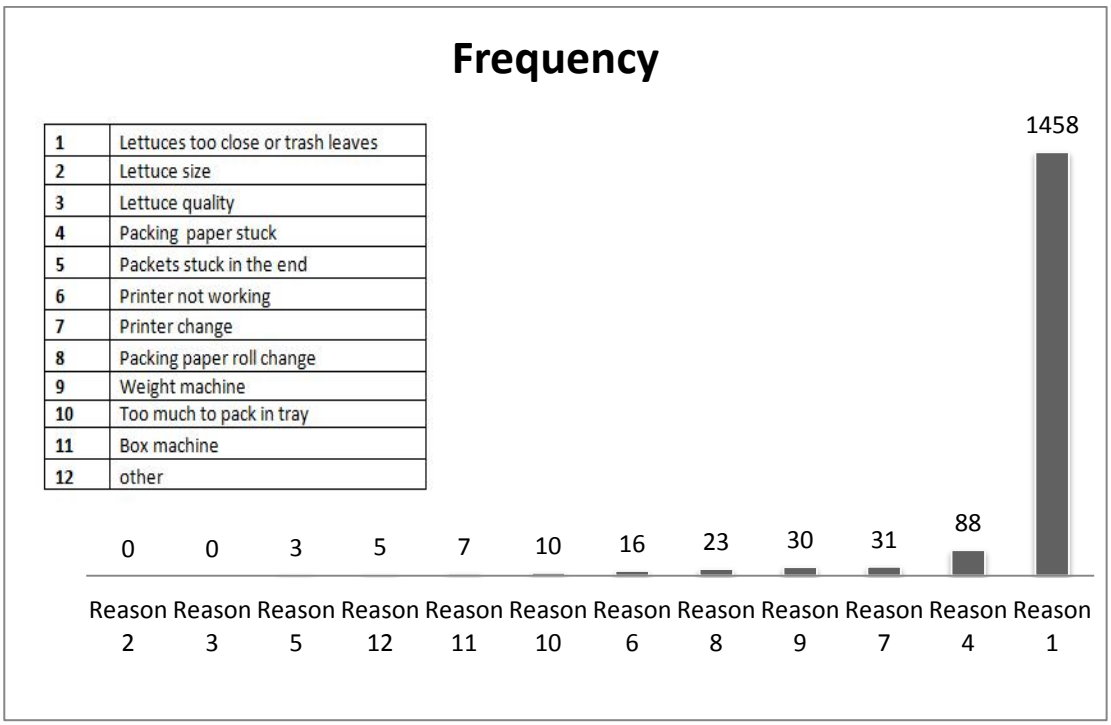


Figure 20. Frequency of the reasons for interruption in the flow packing system

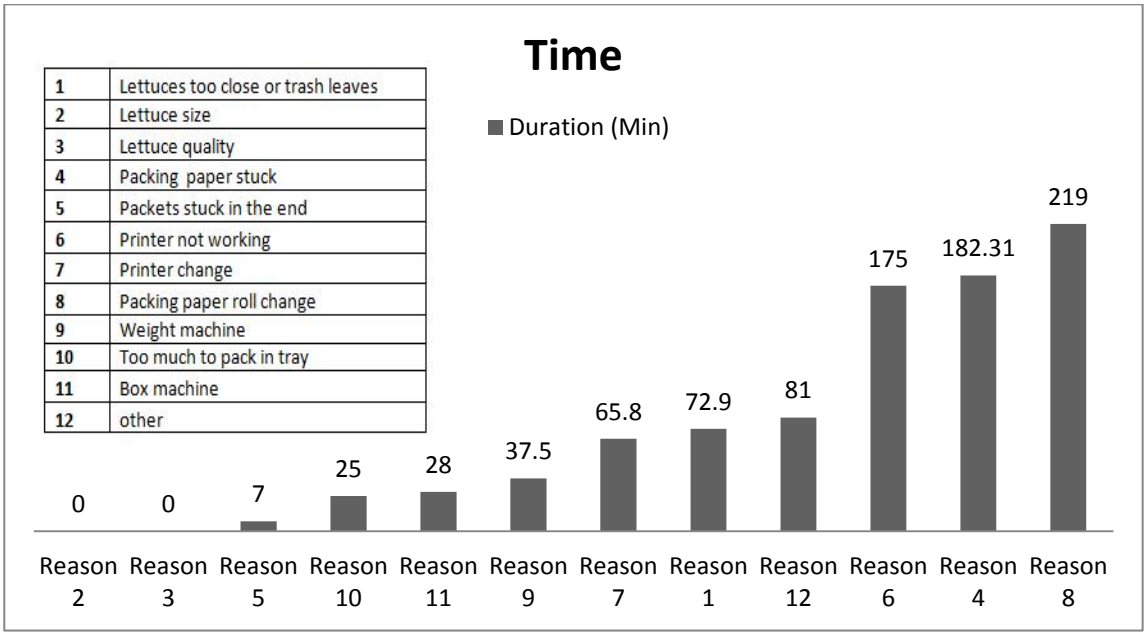


Figure 21. Time duration of interruptions in flow packing system

Figure 20 shows clearly that reason 1(lettuces too close or trash leaves) is the most happening number in terms of frequency. While when we look at that reason in terms of time , it can be seen that this reason stopped the system for 73 minutes, that means packing system was getting interrupted 1458 time because of this reason but time duration for interruption was few seconds for every time .

The second reason for interruption is reason 4 (paper stuck issue). This issue is not much in number but if we look at the duration, this reason is holding the system stopped for longer time. In this reason the wrapping film gets stuck in the end sealers. As per machine's manual, this issue can be resolved by adjusting the end sealers temperature

Reason 8 (packing paper roll change) is the most time taking reason as per graph. Packing paper is changed every day after the roll gets finished. On the average there are two to three rolls changed in a day and it takes almost 10 to 15 minutes in changing one roll. The third most time taking reason is reason 6 (printer not working). Flow packing machine is equipped with special printers to print the required text on the packing sheet. Sometimes these printers stop working leading to packing interruption. As reason 7 (printer cartridge change) and 12(other reasons) are almost at same level in terms of time. When the frequency graph is looked, reasons 9 (weight machine stopped working) and 7 (printer cartridge change) are frequently happening. Reason (weight machine) is related to the

malfunctioning of an automatic weight machine installed between conveyor line and flow packing machine. While reason 7 (printer cartridge change) is related to packing machine printers. Cartridge is needed to be changed frequently if it finishes during packing process. Rest of the reasons are not so frequent neither time taking that they have a very little effect on the efficiency of the whole system. These reasons are increasing the production cost in following aspects.

- Production time

  All of these reasons are affecting the packing system stopped for some time. During that time the workers are not doing anything but waiting for the system to start working again. The production required to be done in that specific time also need an extra time and extra resources will be required for that. This will ultimately end an increase in the production cost.

- Product wastage

  The cut lettuces cannot stay fresh if it doesn’t reach place with the required low temperature soon. If the packing system stops for long time the product waiting on the conveyor line cannot be used for packing which leads to product wastage. Ultimately it will decrease the output and increase the cost.

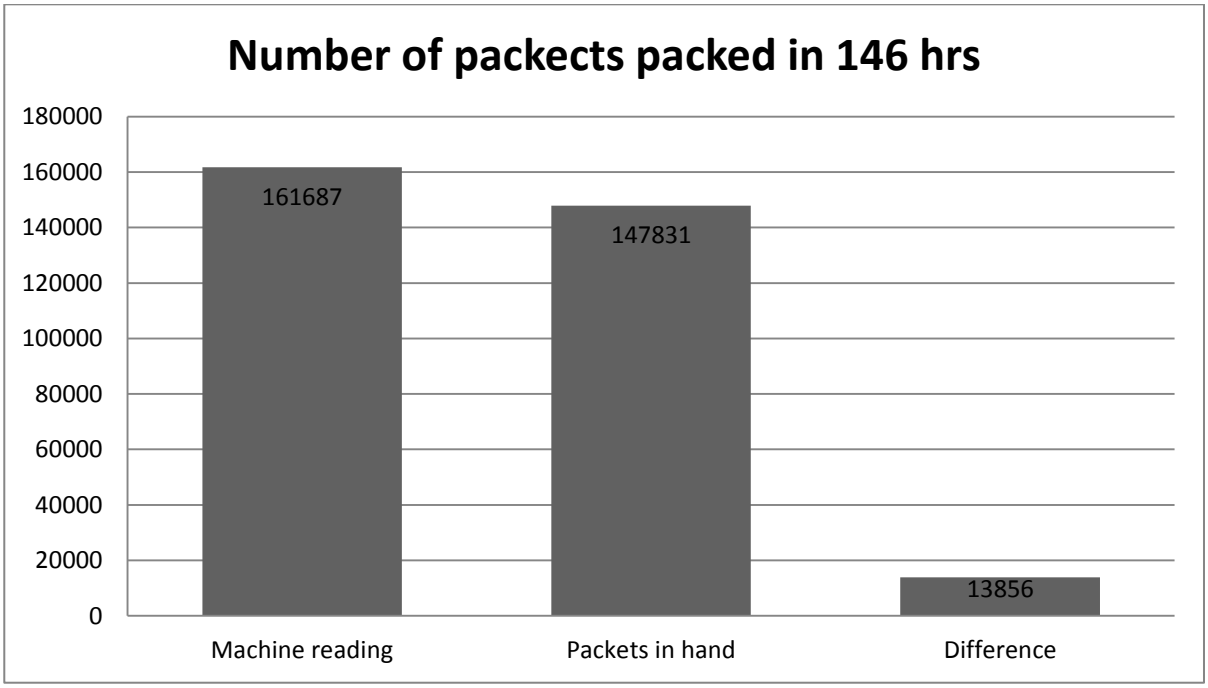


Figure 22. Production loss in flow packing machine

By looking at figure 22, it can be seen that there is 9 % difference in actual packets in hand and machine packing. Machine packing means machine has packed out this number while packets in hand are the final packets packed into the boxes. There is wastage of 9 % clearly seen. Reasons for this wastage were mostly related to printer's performance. There is a need of technical maintenance for these printers in order to reduce this wastage.

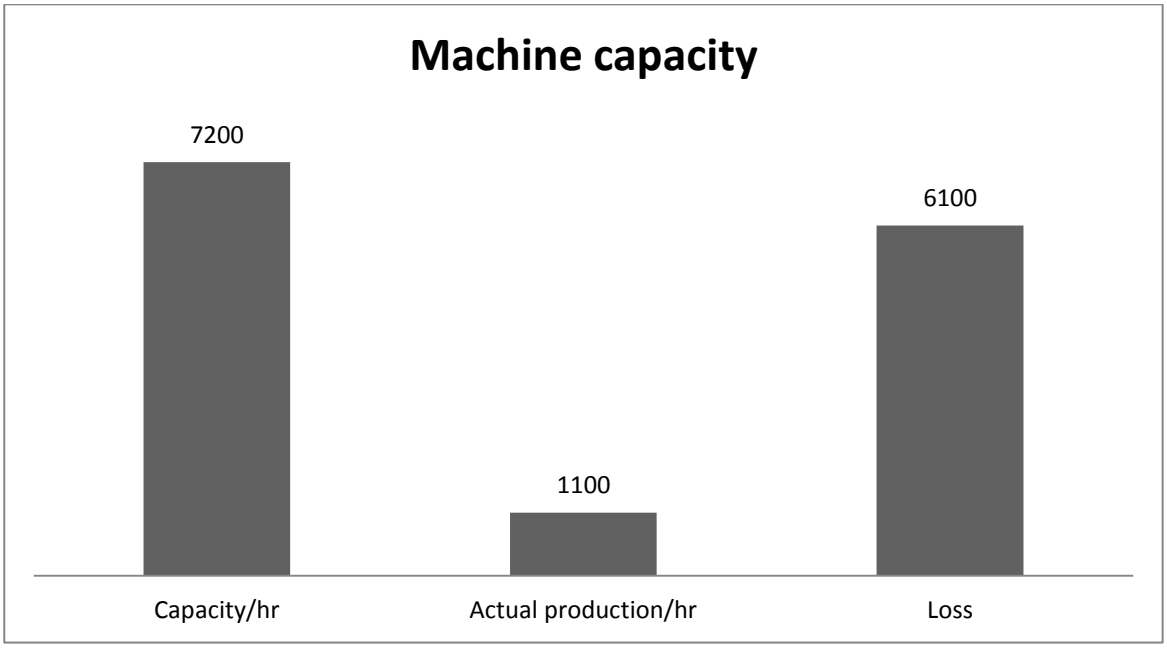


Figure 23. Machine capacity and actual performance

Figure 23 shows that the flow packing machine is capable of producing 7200 packets in one hour, but unfortunately company is able to use only 15 percent of machine's capacity. That means if the machine is utilized at its actual capacity, company can save the production time, which can lead to a decrease in production cost. This can be done by increasing the machine and conveyor line speed, but a special planning is required to synchronize the whole process accordingly. One the main reason in continues machine stop is reason 1 (Lettuces too close or too many trash leaves). If the speed of the machine and the conveyor connected to the machine is increased, it will automatically create a space between the low speed product coming on the following conveyor which can help the person to take of the trash leaves easily and manage the required space between the products as per machine requirement.

5 CONCLUSIONS

5.1 Main findings of the research

Researcher observed the complete flow packing unit deeply and studied all the processes involved in it. This study relates the theoretical framework of process management and development with the practical relevance of processes in flow packing unit in Famifarm Oy. This study focused on finding the factors affecting the efficiency of this system. The purpose of the study was to find out the reasons which are not letting the production unit work as efficient as it could work.

Researcher was able to learn the aspects of the system and understood the management systems and processes in flow packing unit. The flow production system is a chain of processes connected to each other to complete a task, so any imbalance at one level of this this chain disturbs the whole system. Researcher was able to learn how the actual production process is managed in a company and how the processes are designed for specific unit.

Quantitative data collection method helped the researcher to find out the specific effects of every reason on the performance of flow packing unit. While qualitative data collection was helpful in understanding resource and quality management system. Researcher compiled the data from both ends of the flow packing unit and found out the rooms for improvement.

5.2 Evaluations and recommendation

The study found out that there are some processes in flow packing unit of the case company, which needed to be modified of upgraded. Study also found that some machines in the unit are also affecting the performance of the system.

Research was done by both qualitative and quantitative methods. Most of the study comprises participation of the researcher as a hand on trainee of the company. After collecting and analyzing data researcher found out that following factors are affecting the performance of slow packing unit:

1) Information communication system is not efficient enough
   Information communication is done through team leaders, but information either doesn't reach every employee or not delivered in time because of different shifts and absence of workers. There is also a language barrier which works as a communication problem in information communication.

2) Standard operating procedures (SOPs) for flow packing unit are not updated. Standard operating procedures designed for flow packing unit are not updated after modifications in the system. Many workers are not even aware of all standard operating procedures.

3) Resource allocation method needs modification
   Resource allocation method is not followed and not mentioned in any standard operating procedures because of which there is sometimes either surplus or fewer amounts of resources over cutting lines. This affects the efficiency of flow packing system.

4) Technical errors in machines need special attention
   There is no service or maintenance schedule for the machines. Therefore many new faults are appearing in the machines. There is need of a process in order to identify the technical issues on regular basis and to keep their follow-up.

On the basis of analysis there are some recommendations drafted to improve the efficiency of the unit:

1) A daily updates system should be designed. The system can be designed by two simple methods.
   A new notice board should be placed next to the login system. All the changes in working conditions (Lettuce condition, cutting instructions etc.) and change in policies should be pasted there. Every worker should be instructed to check daily updates every day before start of work. Older

updates up to one week should be pasted on the same board so missing people can also keep themselves updated.

The same system mentioned above can be implemented with a digital display screen connected to a computer in team leads office, so the information can be updated easily through computer.

This daily update system will help easy and authentic information communication which can keep the knowledge level of all workers at same level.

2) New and detailed standard operating procedures should be designed for the unit. There should be different set of standard operating procedures for packing room and cutting lines. Standard operating procedures should be simple and easy to follow. Also some major points of standard operating procedures should be pasted on the working places in order to keep the reminder for workers. This will help every worker to follow same set of rules without any ambiguity.
3) A detailed study should be made in order to modify the resource allocation system for the unit. This will help to assign right number of people on the working lines and packing room. This modification will help to reduce access of resources and interruptions in the process.
4) There should be a scheduled maintenance and servicing of the machines and lines. All the repeated problems should be documented frequently and provided to the service engineers in order to get them rectified.

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APPENDICES

Appendix 1

Date:_____

		ST		ET		NPP		MSR		MER			
Sr#	1	2	3	4	5	6	7	8	9	10	11	12	Dur
1													
2													
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17													
18													

number of packets packed	NPP	
machine start readng	MSR	
machine end reading	MER	
duration	dur	
start time	st	
ending time	et	

1	Lettuces too close or trash leaves
2	Lettuce size
3	Too much trash leaves
4	packing paper stuck
5	packets stuck in the end
6	PM printer not working
7	PM printer change
8	packing paper roll change
9	weight machine not working
10	too much to pack in tray
11	box machine not wrking
12	other

Appendix 2 Discussion topics with workers

1) Standard operating procedures
2) Working regulations
3) Product quality

Appendix 3 Interview questions for company personnel

1) What type of knowledge is required for recruitment of workers in production department?
2) What are the criteria of selection of workers for flow packing unit?
3) What method of resource allocation is used in flow packing unit?
4) How the workload is divided in two shifts?
5) How the plants quality effect resource management?
6) How the information communication system is managed in the flow packing unit?
7) How the product quality is checked before and after packing?
8) What training system is followed for old and new workers?
9) What standard operating procedures are defined and where are the available for workers?
10) What is process to check human resource performances?


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