Improving Selected Logistic Processes in Brose CZ spol. s.r.o

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Master's Thesis

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MASTER'S THESIS ASSIGNMENT

(PROJECT, ARTWORK, ARTISTIC PERFORMANCE)

Degree, First Name and Surname:	**Christopher James Can**
Personal Code:	**M140241**
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Thesis Guidelines:

Introduction

Define the objectives and the application methods used in the Master thesis.

I. **Theoretical part**

- **Compile literature review focused on research related to Production Process Improvement.**

II. **Practical part**

- **Analyze production process of Company Brose CZ spol. s.r.o. and identify the main areas that could be improved.**
- **Prepare a project of improving production process in Brose CZ spol. s. r.o. based on the results of previous analysis.**
- **Evaluate presented proposals economically.**

Conclusion

Thesis Extent: **cca 70 stran**

Appendices:

Form of Thesis Elaboration: **tištěná/elektronická**

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Lastly I would like to thank Tomas Bata University for this exciting academic experience.

I hereby declare that the print version of my Master's thesis and the electronic version of my thesis deposited in the IS/STAG system are identical.

ABSTRAKT

Cílem této diplomové práce je analyzovat vybrané logistické procesy Brose s.r.o. a identifikovat hlavní oblasti, které by mohly být zlepšeny. Práce je rozdělena do dvou částí, teoretické a praktické.

Teoretická část poskytuje informace o podmínkách, týkajících se měření produktivity práce, zlepšování procesů a snížení odpadu v postupu.

Praktická část je popis současného stavu procesů ve společnosti a návrh na zlepšení jejího logistického procesu, který se zaměřuje na přemapování doručovací přepravní cesty a na pracovní proces v konečné fáze výrobní linky.

Konec diplomové práce zahrnuje vyhodnocení návrhu z finančního i nefinančního pohledu.

Klíčová slova:
produktivita, zlepšování procesů, snižování produkce odpadu, logistika

ABSTRACT

The aim of this master thesis is to analyze selected logistics processes of Brose s.r.o. and identify the main areas that could be improved. The thesis is divided into two parts, theoretical and practical. The theoretical part provides information about terms relating to productivity work measurement, process improvement and reduction of waste in workflow. The practical part is a description of current situation processes in the company and a suggestion for an improvement of its logistics process, which focuses on delivery transportation path remapping and work process in final production line. The end of the thesis is a proposal valuation from a financial and non-financial point of view.

Keywords: Keywords: productivity, process improvement, waste reduction, logistics,

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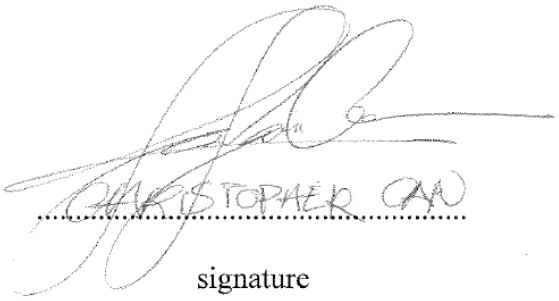

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INTRODUCTION

The concept of "logistics" started many years before Christ and was used by Greek generals (Alexander the Great) in order to describe all the procedures for the army's procurement on food, clothing, ammunition supply, reinforcement of troops, etc. Alexander the Great was a big fan of the mobility of his troops and he didn't want his troops to stay in one place waiting for supplies from Macedonia. Thus he tried to resolve the issues of supplies by using supplies from the local resources of his defeated enemies. For many years, logistics were always an issue in war affairs. Kingdoms and generals with strategic planning on logistics were those who won the war against their rivals. Alexander the Great utilizing a well-planned logistics in all of his battles earned him the title "The World Conqueror". This fact about strategic planning on logistics remains to be prevalent during the start of manufacturing in the 18th century, later on from the early 60's, many factors such as deregulation, competitive pressures, information technology, profit leverage and globalization contributed to the increase of logistics science. Companies with a well planned logistic process stands out to generate more profit than its competitors as it improves both performance in production and customer service - which by far is one of the major driving factors of a successful business, i.e., Toyota, Ford automobile manufacturers.

Perhaps one should ask, what is Logistics? There is one quite widely accepted view about it: Logistics = Supply + Materials management + Distribution. Lately, a more scientific definition was used: Logistics is the process of planning, implementing and controlling the efficient, effective flow and storage of goods, services and related information from point of origin to point of consumption for the purpose of conforming to customer requirements (Council of Logistics Management). Logistics management tries to have the 'right product', in the 'right quantity', at the 'right place', at the 'right time' with the 'right cost'.

Brose s.r.o has recently been experiencing waste from distribution of its final product from the production area. The company is aiming to eliminate imperfections and improve the current operational system and it heads the task of efficiently optimizing certain logistic processes to maintain its competitiveness.

The objective of my thesis is to analyze the current state of logistic activities, detect wastes and its causes, inefficiency and imperfections of tasks, and suggest improvements that will lead to better organization and retaining the company's valuable earnings.

The first part of my thesis provides theoretical background about logistics, and methods of process improvement, while taking into account the methods of process improvement, I am going to give emphasis in identifying the type of wastes since the company I am analyzing is a manufacturing company which is commonly prone to have at least one of the 8 types of wastes, through these methods it will help me gather possible resolution to the problem or perhaps even prevent future operational problem in the company. The analysis part gives a detailed description of brose CZ s.r.o operation (work flow) in the production area where the finished products are being transferred to the final distribution area. I am analyzing the transportation flow of tugger trains and forklifts by measuring the actual operations, and analyzing the capacity of strapping machine with regards to the number of boxes it can operate efficiently. The goal in optimization proposal is to provide path optimization to improve distribution of final products within the working stations in order to prevent unnecessary costs for the company and avoid dissatisfaction from customers whenever demand increases.

OBJECTIVES AND METHODS OF MASTER THESIS PROCESSING

This Master's Thesis aims to contribute in the field of continuous improvement in manufacturing company by identifying both the indigenous and exogenous problems.

The main research objective is:

- To improve distribution of finished goods for final delivery in brose CZ s.r.o by 15%-20%

Additional research objectives are:

- To analyze how the workflow system affects overall production performance
- To identify wastes that contributes to work inefficiency
- To analyze the distribution capacity of transport machines

The research questions are:

1. What logistics strategy will brose company use in order to maintain the factory's competitiveness to deliver on time with clients
2. What factors contribute to the incurring distribution problem in production area?
3. How many transport machines are needed to mitigate distribution of final products when demand starts to increase?
4. Are the current number of machine s and workers sufficient enough to establish an efficient logistic process?
5. What measures should be taken to improve current logistics processes?

The research methodologies:

Spaghetti diagram was used for analyzing the current distribution flow of transport machines, moreover a flow diagram was used in order to perform value stream analysis which identifies processes which adds value and non value to the products and services of brose CZ s.ro. The cost; risk and time analysis were also used for this research.

I. THEORY

1 LOGISTICS

In the 21st century, logistics has never been more important to business owners in maintaining competitiveness and generating profit, the concepts of logistics has proven itself to be reliable and effective, most especially in the industry of manufacturing. Another perspective would be that the main task of logistics is to deliver the required products in proper quantity and quality, to the right place at the right time with the right costs (minimal costs).

The Council of Supply Chain Management Professionals states that "Logistics is the part of Supply Chain Management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customer's requirements (MURPHY & WOOD, 2008, p.6)

As an overview, the mission of logistics management is to plan and co–ordinate activities that are fundamental for achieving high level of service and quality at lowest possible cost. The needs of customers are satisfied simply because of better organization of material handling and information flows that extend from the marketplace through the firm and its operations, and beyond to suppliers. (MARTIN, 2011, p. 11)

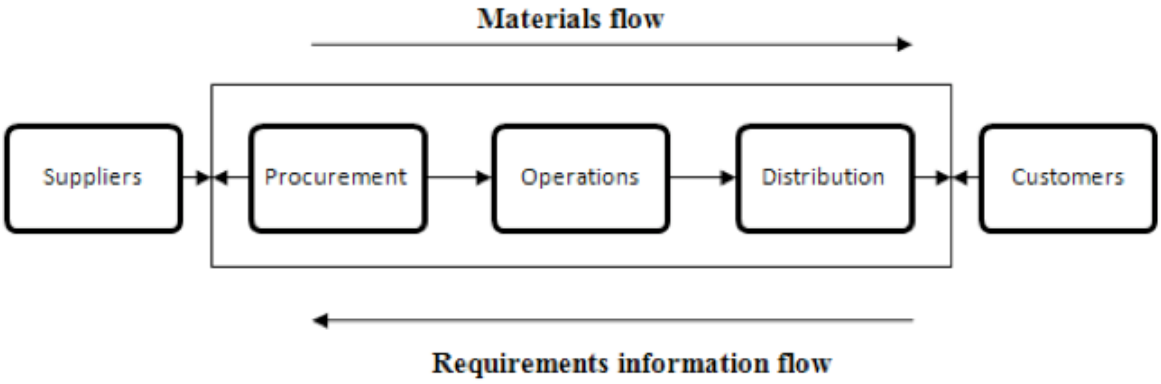

Figure 1: Logistics management process (MARTIN, 2011, p.11)

1.1 Logistics activities and fields

Here is a basic description in the nature of logistics activities between inbound and outbound logistics:

1. Inbound logistics - one of the primary processes of logistics concentrating on purchasing and arranging inbound movement of materials, parts, and/or finished inventory from suppliers to manufacturing or assembly plants, warehouses, or retail stores.
2. Outbound logistics - this process is related to the storage and movement of the final product and most especially the related information flows from the end of the production line to the end user.

A general overview of the main fields in logistics:

- Procurement logistics
- Distribution logistics
- After-sales logistics
- Disposal logistics
- Reverse logistics
- Green logistics
- Global logistics
- Domestics logistics
- Asset Control Logistics
- POS Material Logistics
- Emergency Logistics
- Production Logistics

The study of my research can be related in these fields of logistics:

1. Distribution logistics – the main task is delivery of the finished products to the customer. It consists of order processing, warehousing, and transportation. Distribution logistics is necessary because the time, place, and quantity of production difers with the time, place, and quantity of consumption.
2. Green Logistics – it describes all attempts to measure and minimize the ecological impact of logistics activities. This includes all activities of the forward and reverse flows. This can be achieved through intermodal freight transport, path optimization and vehicle saturation.

2 PROCESS IMPROVEMENT

Process improvement refers to making a process more effective, efficient, or transparent. It is any sequence of activities, associated tasks required to meet goals or objectives. We should also take into account that inputs to the process become outputs. Initially, there is always a person (process owner) who is responsible for the process. He coordinates and organizes the process with the employees involved in it and lastly he controls results. Key processes are the processes that have the greatest impact on customer's value opinion about the product or service and the greatest impact on customer retention. (JESTON & NELIS, 2008, p. 4–8; SUMMERS, 2011, p. 99)

An organization that conducts process improvement focuses on proactive problem resolution in order to avoid operating in crisis management mode when process degradation occurs.

Process improvement helps an organization:

- Reduce unnecessary business costs
- View process value through the eyes of the customer
- Define, manage, and measure processes in order to regularly evaluate everything using data-driven information
- Break down process silos by contributing to an understanding of how processes interact and impact one another and customers

Process improvement primary goal is to identify and understand issues in order to recognize solutions and implement improvements to stay aligned with customer needs and expectations.

Ways to effectively improve processes:

	Steps
1	Determine the objective
2	Determine the boundaries
3	Involve representatives from each major activity involved
4	Identify the process owner
5	Create a process map
6	Separate the value–added activities for non–value–added activities
7	Eliminate non–value added activities
8	Identify, analyze and eliminate variation
9	Determine whether the remaining value–added activities are truly the best practice
10	Redesign process using the knowledge gained in the previous nine steps

Figure 2: 10 steps in process improvement (SUMMERS, 2011, p.101)

2.1 Process mapping

Process mapping provides graphical overview of all the activities involved. It is very useful tool for better understanding a certain workflow process. Creating a process map helps to identify waste and non–value–added activities. (HARMON, 2007)

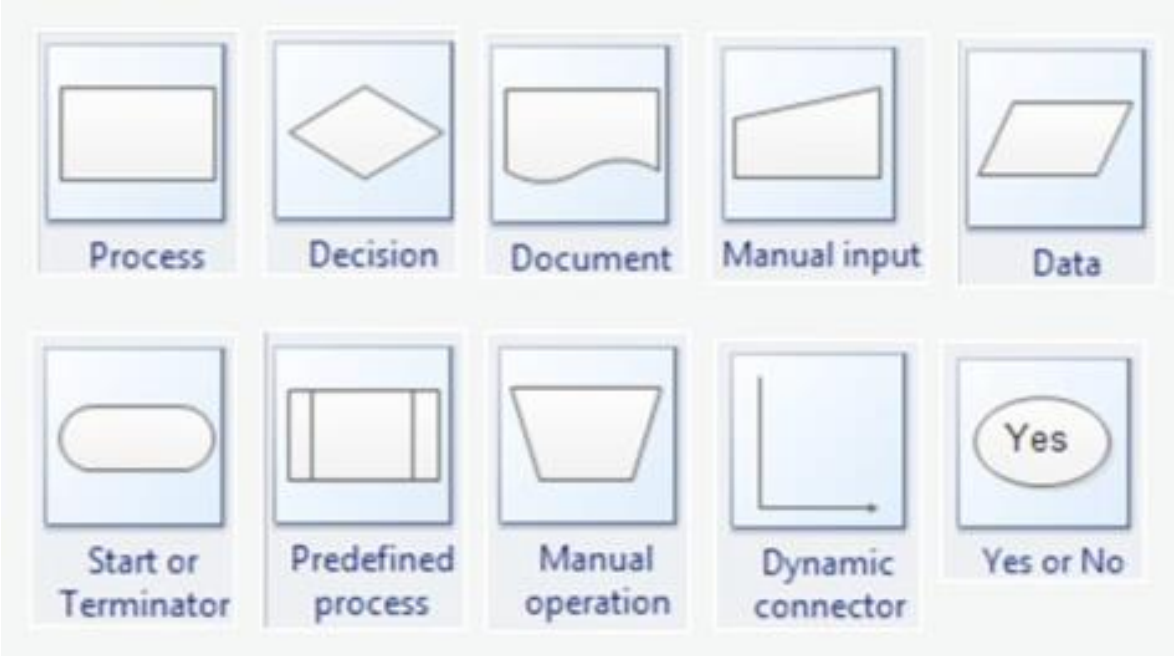

Figure 3: Common used process map icons

2.2 Value Stream Analysis

The value stream is the whole collection of activities necessary to produce and deliver a product or service. Value stream analysis separates those activities that contribute to value creation from activities that create waste, and identifies opportunities for continuous improvement.

2.2.1 Value added and non value added activities

A high-level value stream diagram is useful to divide the total value stream lead time into value-added (VA) and non-value-added (NVA) categories. The percent of total cycle time consumed by non-value-added activities is often shockingly large - in maximum excess of 80%.

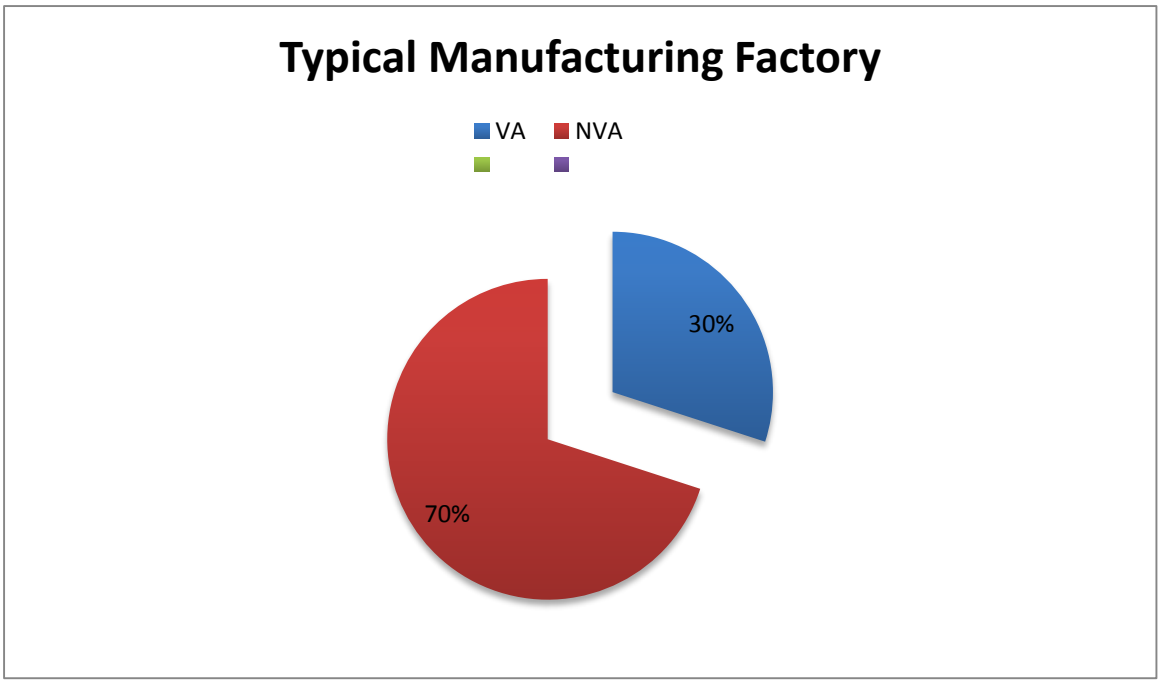

Figure 4: Value added and Non value added chart

We can assume that NVA activities are those activities a customer would not be willing to pay for in connection to the circumstance that they would know the overall process in production of a particular product.

One of the best solution for this is to reduce non-value-added activities so that the value-added activities become 90 % of total costs.

2.2.2 Steps to improve processes

Step 1. Identifying a process which adds value:

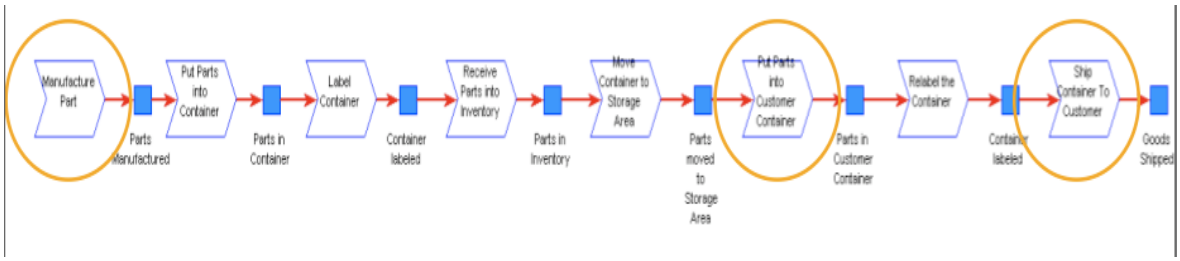

Figure 5: Example of current value added process

With the current process given, we can easily identify which process is important to the whole workflow, it is important to take note of it to be able to proceed to the next step.

Step 2. Eliminating a step or process which does not add value:

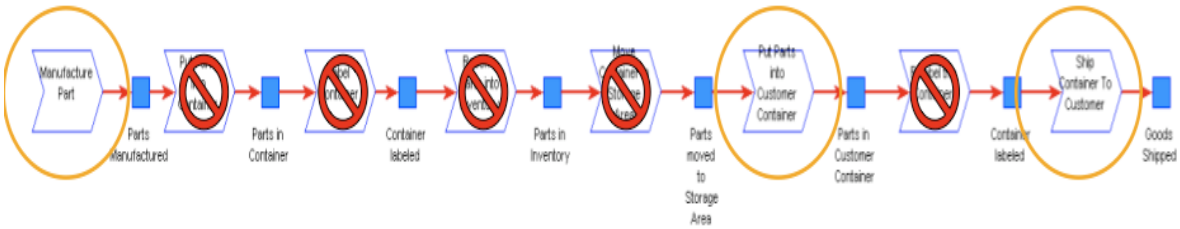

Figure 6: Example of current non-value added process

On the next step, as we go over the identified processes which adds value to our product and services, we can see the other process which gives lesser or non value to our product.

Step 3. Improved process:

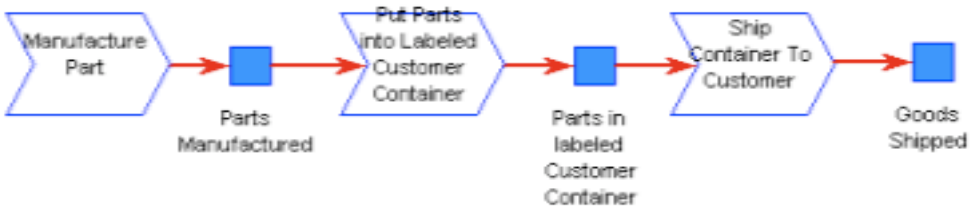

Figure 7: Example of new process

Here in the last step, we can combine the processes that were not eliminated. This time around it gives managers an overview of the correct processes in production, thus giving the company an efficient and effective high-level production performance.

2.2.3 Risks of Not Improving Processes

In every manufacturing business when key stakeholders are involved in process improvement, they can collectively focus on eliminating waste—money, time, resources, materials, and opportunities. Usually we tend to waste these precious elements when we fail to examine the processes we use to conduct our business. With improving processes, work can be completed more cost effective, quick and easy.

2.3 Waste

In identifying a process, we call activities that do not add value as wastes. These are the 8 common types of waste:

- Overproduction - is continuous production without orders that results to increase of inventory.
- Idle Time - workers are waiting for next processing step of automated machine. Workers have to wait due to delays of materials and bottlenecks.
- Unnecessary transportation - it is caused by long distances between workstations or warehouses. Typical key tool for identification of this waste is making a spaghetti diagram.
- Over processing or incorrect processing. Processing can be inefficient when using the wrong type of tools and product design.

- Excess inventory – maintaining unnecessary amount of materials or excessive amount of supplies that could potentially expire.
- Unnecessary movement – doing something that does not relate to the work in pro cess.
- Defects – defective part is an additional cost for rework/repair, shipping charges and customer dissatisfaction.
- Under utilized people - unused creativity, talent knowledge of the organization. (STRUPE, 2009)

2.4 Lean and Six Sigma

Lean and Six Sigma concepts are often combined, they share the common goal of delivering and continuously improving business processes. Both Lean and Six Sigma focus on defining success from the customer's perspective and require a complete understanding of the business process in order to implement improvements. We can further say into detail that Lean is intended to review the entire process to identify and eliminate waste within the process, whereas Six Sigma focuses on individual sources of defects to determine the root cause and improve the process to reduce or eliminate those defects.

Often times when a Lean solution for a problem can't work nor can't be identified, a Six Sigma-style approach may be an appropriate recommendation. "Knowing each area individually is important for understanding the whole concept". (MARTICHENKO & GOLDSBY, 2005, p. 3–4; STRUPE, 2009)

Lean Tools
o Kaizen
o 5S
o Kanban
o Value stream process mapping
o Standardized work
o Visual management
o Productive maintenance

DMAIC:

(Define, Measure, Analyze, Improve and Control) provides the framework to improve existing processes:

- Define – typically projects begin with a plan and the purpose of this step is to clearly articulate the business problem and goal by identifying the problem and describing what needs improvement, the problem itself, the current versus future state and the scope of an improving process.
- Measure – use facts and data to understand objectively how your process work so that you can describe the problem more efficiently
- Analyze – identify facts and data to determine or select the root causes of the problem
- Improve – purpose of this step is to identify, test and implement a solution to the problem, this serves as a prevention step to process problems, examples would be troubleshooting, verification, simulation and modeling
- Control – in this phase you are ready to implement the solution, the purpose of this step is to sustain the gains, check if customer felt the difference in your performance, and retain changes. (MORGAN & BREIG_JONES,2012,p 25-37)

Figure 8: DMAIC Six Sigma

The Six Sigma professionals:

Training in Six Sigma are expressed on different levels:

1. Master Black belt – trains and coaches Black Belts and Green Belts, works as development advisor with senior executives to ensure the overall Six Sigma project is meeting strategic direction of the business.
2. Black belt – leads complex projects and provides expert help with the tool and techniques to the project teams. Trains and coaches project teams.
3. Green belt – trained on the basic tools and lead fairly straightforward projects, helps Black belts with data collection and analysis.
4. Yellow belt – project team members, basic level of most commonly used tools, can carry out mini projects themselves in their local work environment under guidance of Black belt.
5. White belt – can work on local problem–solving teams but may not be part of Six Sigma project team, understands basic Six Sigma concepts from an awareness perspective. (MORGAN & BRENIG-JONES, 2012, p. 38)

2.5 5'S

If you can't do the 5S, you can't do the other work. (OSADA, 1991, p.3) It is quite evident to see for a successful company to be organized, standardized with clean environment. All these parameters are covered by methodology of 5S. They say that the most difficult operating procedures have to start with the 5S and here is a quick overview:

5S's activities:

Seiri = Organization

In general use this mean to put things in order. In 5S terms, it means to distinguish between necessary and unnecessary things, to make hard decisions, and to implement stratification management to get rid of unnecessary. Stratification management means dividing things and grouping them in order of importance. (OSADA, 1991, p.25)

Seiton = Neatness

This means having things in the right places so they can be used in at the right time. It is a way of eliminating searches which contributes to waste of time. Once everything is

functionally placed for quality and safety, you have a neat workplace. (OSADA, 1991, p.27)

Seiso = Cleaning

It means getting rid of a waste, grime, and foreign matter and making things clean. Cleaning is form of an inspection. With higher quality, higher precision and finer processing technologies, even the smallest detail can have big importance. (OSADA, 1991, p.29)

Shitsuke=Discipline

The aim is to create a workplace with employees manifesting in time, good habits and discipline. It means having the ability to do things the way they are supposed to be done. Bad habits are broken and good habits are formed. (OSADA, 1991, p.32)

Seiketsu = Standardization

Standardization means continually maintaining your organization, neatness and cleaning. The emphasis is on visual management and 5S standardization. Good visualization and standardized conditions allows you to act quickly. (OSADA, 1991, p.31)

2.5.1 Visual management

Transparency is the one word that can describe visual management. "Transparency refers to enabling anyone to have the ability to see, in real time, what is happening with a process. From the instantaneous information they gather, they should also be able to determine whether anything has changed or has to be changed." (SUMMERS, 2011, p. 153)

There are different types of visualization tools:

- Information boards
- Floor marks
- Cards
- Photographs
- Graphical marks on the walls
- Signaling equipment

Logistics use visualization tools to label racking and locations, mark walking paths, label

docks, storage areas, waiting bays and many more.

3 ANALYSIS AND MEASUREMENT OF WORK

In companies the analysis and measurement of work are often perceived from two perspectives. Group A takes for granted this topic, with main purpose on continuous increase of performance at any cost. Group B sees the main advantages brought by this methodology to improve current productivity and streamline performance of individual work tasks. The goal of this analysis is to increase performance of working process by simplifying work and using working time efficiently. Productivity does not mean to work faster, but to work more in a way that is sensible and reasonable.

Measurement and analysis involves gathering quantitative data about products, processes, and projects and analyzing that data to influence your actions and plans. (IPA Slovakia, 2012)

3.1 Measurement and analysis activities usage:

- Characterize, or gain understanding of processes, products, resources, and environments
- Evaluate to determine your status with respect to your plans
- Predict by understanding relationships among processes and products so the values you observe can be used to predict others
- Improve by identifying roadblocks, root causes, inefficiencies, and other opportunities for improvement

3.2 Methods of work study and work measurement

Work study is a systematic examination of activities in order to improve the effective use of human and other material resource (British Standard Institute). In work study there are three assumptions which are:

- There is always more than one method to do a task or a job
- Solving problem through scientific methods is better than other method
- Work can be measured in time unit

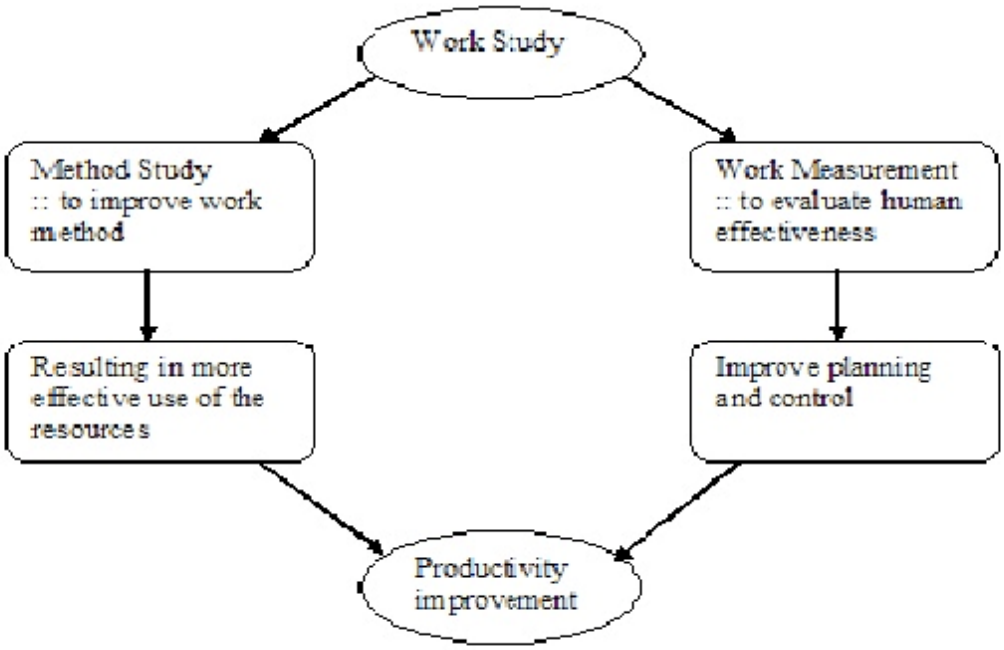

Figure 9: Study of work chart

The objective of work study is to find the best and most efficient way of using the available resources such as men, material and machinery. Method study is one of principal techniques by which work content in the product manufacture or process could be decreased and according to (British Standard Institute) method study is a systematic recording and critical examination of ways of doing a job in order to make improvement.

By applying method study, the work measurement is the next important steps to find out the time required to complete the operations. Work measurement is useful to find out the time allowed to complete the job using the selected method (Institute of Management Service). Work measurement is defined by British Standard Institution as the application techniques designed to find out the time for the qualified worker to carry out a task at the defined rate of working.

3.2.1 Benefits and Advantages

Four major advantages of work study:

a) Higher productive efficiency

b) Create better employee-employer relations

c) Provide better service to customers

d) Provide better working conditions to the employee and employer

Advantages that can be obtained from method study:

a) Improved working processes and standardized procedures

b) Create better work place layout which is more neat and clean environments and working conditions

c) Reduce fatigue to the operators

d) Produce better product quality

e) Bring out the effective used of men, materials and machinery

Advantages that can be obtained from work measurement:

a) Determine the time required to do a job which the time obtain will be compared to alternative method and define the fastest method

b) Determine the resources required, budgeting and costing for a job

c) Provides information for effective production planning and maintenance procedures

d) Aids in calculating exact delivery dates

e) Provides a basis for fair and sound incentive schemes

II. ANALYSIS

4 COMPANY INTRODUCTION

The business that Max Brose started in 1908 has become a globally successful company with over 24,000 employees. Its history is characterized by a strong vision, entrepreneurial courage and determination to succeed.

Figure 10: Brose logo

The brose logo is an important brand that reflects its attitude. It is a subtle, no-frills logotype that stands for quality, innovation and technical expertise – professional, clear, without any dominant uppercase letters, written in cool red.

The Family owned business goal is a self-financed growth, which at the end makes stability for the business. This is how it has established itself as one of the top 40 companies in the industry worldwide. In this century, it is the fifth largest automotive supplier in family ownership and with numerous patent application per year, it is also considered one of Germany's most innovative companies. The company makes sure to maintain its competitiveness by investing eight percent of its revenue in research and development.

The family puts the company first, ahead of its own personal interests. The family shareholders, Advisory Board and Executive Management Board work together in a spirit of constructive criticism, laying the foundations on which Brose can continue its success story.

In fiscal 2015, the corporate group generated sales of approximately 6 billion euros. Brose ranks among the TOP 40 of automotive suppliers worldwide and is the fifth-largest family-owned company in this industrial sector. Every second new vehicle worldwide is equipped with at least one Brose product.

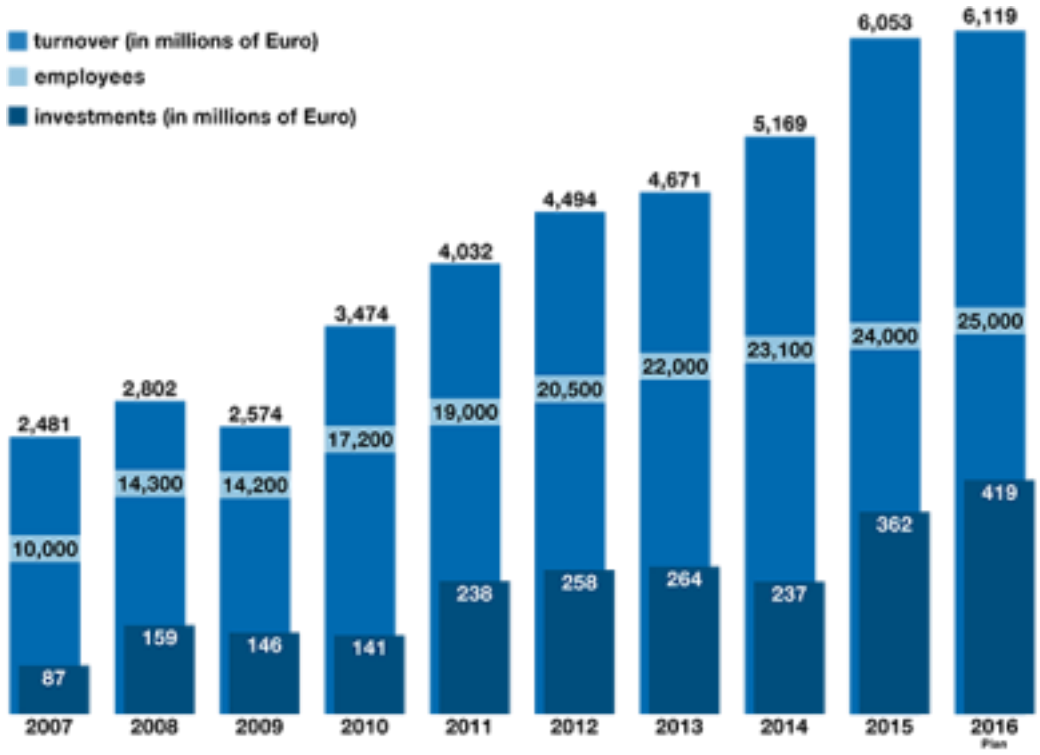

Figure 11: Company annual investment turnover report

Brose company operates all over the world, here's a list of Brose locations operating in Europe, Africa, America and Asia:

Country	Location
Belgium	Ghent
Germany	Bamberg, Berlin, Bremen, Coburg (Head Quarters), Gifhorn, Hallstadt, Meerane, Munic, Oldenburg, Rastatt, Sindelfingen, Wolfsburg, Wuppertal, Wurzburg
France	La Suze, Paris
United Kingdom	Coventry Bedworth, Coventry Foleshill
Italy	Melfi, Turin
Portugal	Tondela
Russia	Moscow, Togliatti
Sweden	Gothenburg
Slovakia	Bratislava
Spain	Sta. Margarida
Czech Republic	Ostrava
Turkey	Istanbul
Hungary	Kecskemet
South Africa	Brits, East London

Country	Location
Brazil	Curitiba, Goina, Sao Paulo
Canada	London (CAN)
Mexico	Quretaro (El Marques), Puebla, Queretaro (Benito Juarez)
United States of America	Detroit (Headquarters), Jefferson, New Boston, Tuscaloosa
China	Changchun, Chongqing, Guangzhou, Beijing, Shanghai (Headquarters, Anting), Shanghai (Malu), Shanghai (Jiading), Taicang, Wuhun
Japan	Nagoya
India	Pune (Hinjawad), Pune (Hinjawadi Village)
South Korea	Incheon, Incheon (Mando), Suwon
Thailand	Rayong

Figure 12: Brose's world locations

4.1 History

1908 - 1955

- Young Max Brose meets by chance his partner Ernst Juhling at the end of World War I.
- Brose's main company catalogue of products grows from year to year. Besides automobile accessories, the product range includes motorcycle and motorboat equipment.

1962-1997

- Only at the age of 23, Michael Stoschek begin managing the enterprise on October 1971. The 70's are a decade of upheaval and new organization for the company, setting the course for the future.
- Brose became the first producer in Europe to develop and manufacture power seat adjusters ; electronic control-unit for power window regulator. Today these technologies have become a worldwide standard for automobile manufacturers.

2001 - today

- Appointment of a new CEO running the company to Jurgen Otto, he is a non-family member of Max Brose.
- In 2008, the corporate group numbers more than 15,000 employees at 50 locations.
- Joint ventures particularly in China and Thailand on the goal to expand its operations in Asia.
- In 2014, the company opened its new locations in South Africa (JiS seat systems) and Bremen (JiS door systems) to expand Bros's production capacity.

Figure 13: Milestones in the history of brose

4.2 Products

Brose is known for its high quality automobile products, the picture below shows the range of quality automobile products it continues to produce and invent through innovation until this day.

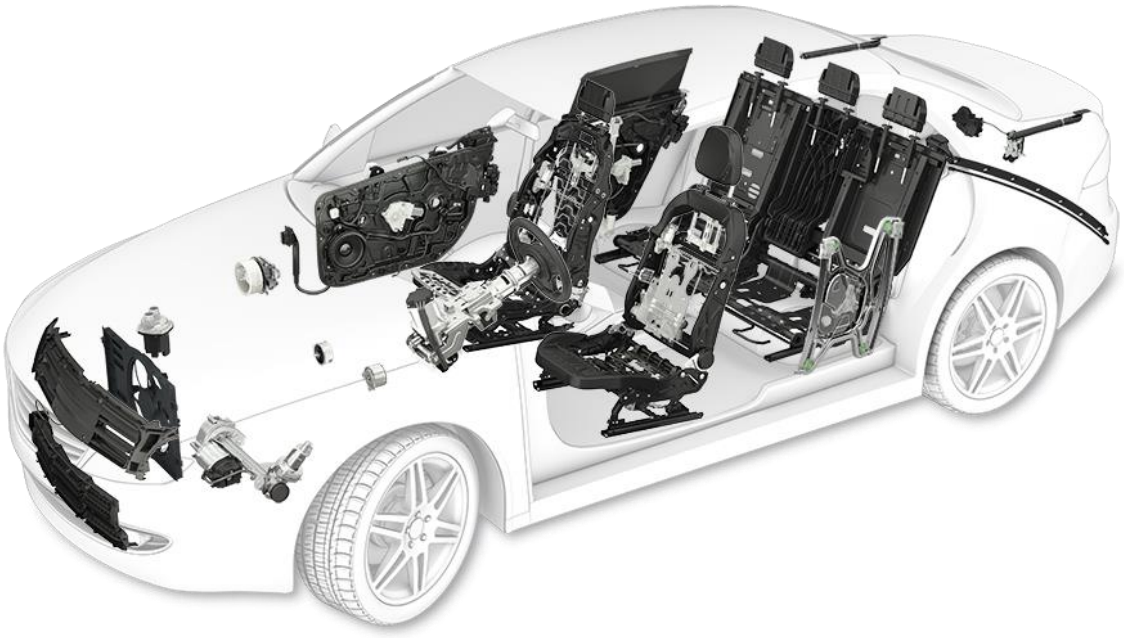

Figure 14: Mechatronic components and systems

The wide range of mechatronic components and system proves the company's competence in the synthesis of mechanical, electrical and electronic systems. Every second new vehicles worldwide is equipped with at least one Brose product, one of the pioneer product of brose is its innovative seat structure design which makes it stand out from other competitors. The expertise of Brose in mechatronics technology increases vehicle comfort, safety and efficiency.

4.3 Customers

Figure 15: Biggest mechatronic components and system customers

Brose proceeds not only to develop and produce the most important car door, seats, window components, but also integrate them into a complete system using sophisticated logistics to ensure that the pre-tested products are ready on schedule for installation at the car manufacturer's assembly line. Once again, over the course of time, Brose's pioneering role in the market remained evident through the loyalty of these big car manufacturers.

5 CURRENT STATE ANALYSIS

In this analysis, I will describe in detail the actual logistics operation in brose: inbound transportation routes of tugger trains and forklifts (Area 6 – Area 12), operation capacity of strapping machine (Area 12) which is responsible for the final packaging of client orders before it will be transferred to storage area (Areas 13 and 14) for final delivery/shipping to client's warehouse. The entire final production area is huge, thanks to the global positioning system (GPS) installed to forklifts and tugger trains in operation, activities of these transport vehicles are monitored with accuracy. Picture provided below represents the working stations in final production, my analysis covers Area 6 to Area 14 of brose's production floor.

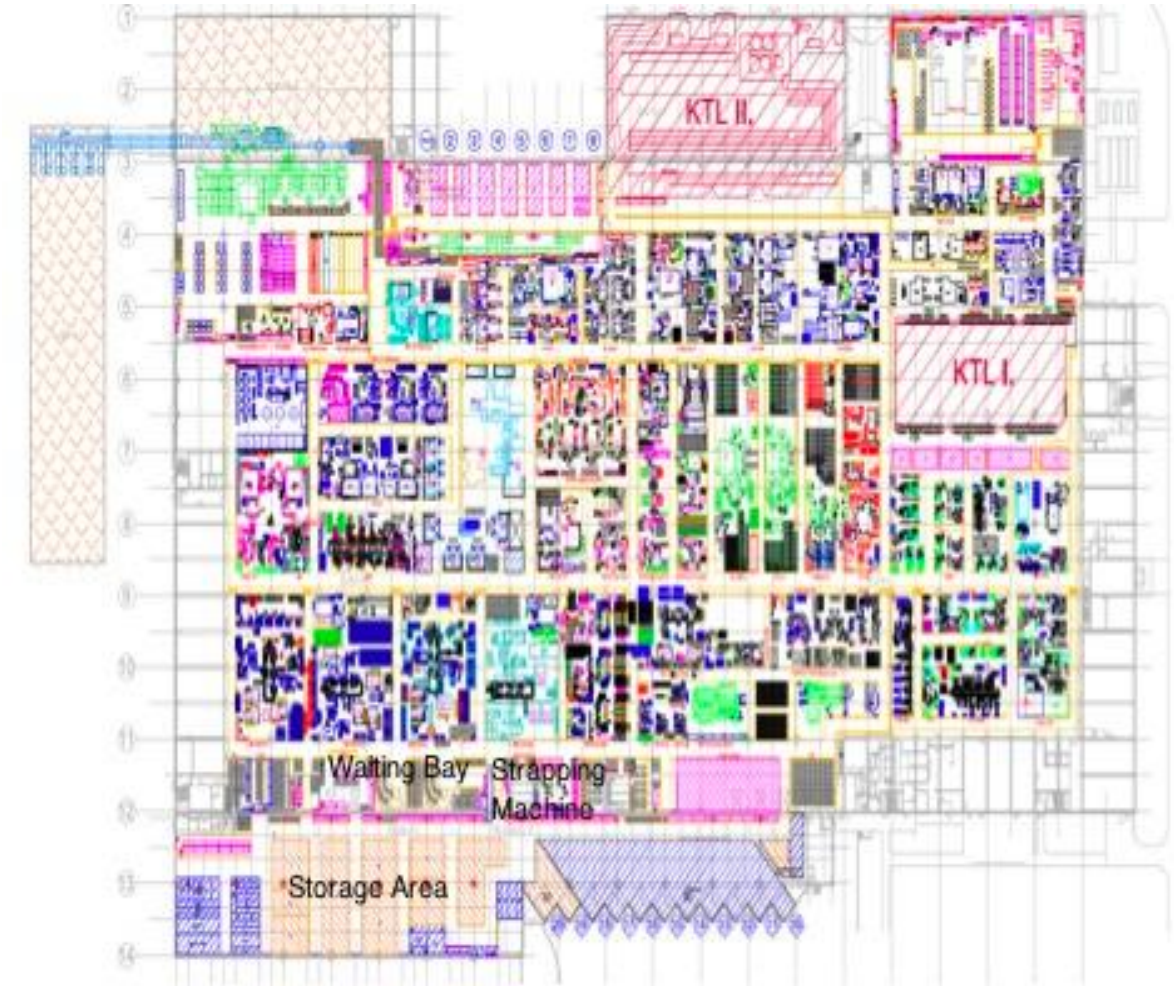

Figure 16: Brose's production floor

5.1 Loading and Unloading Areas

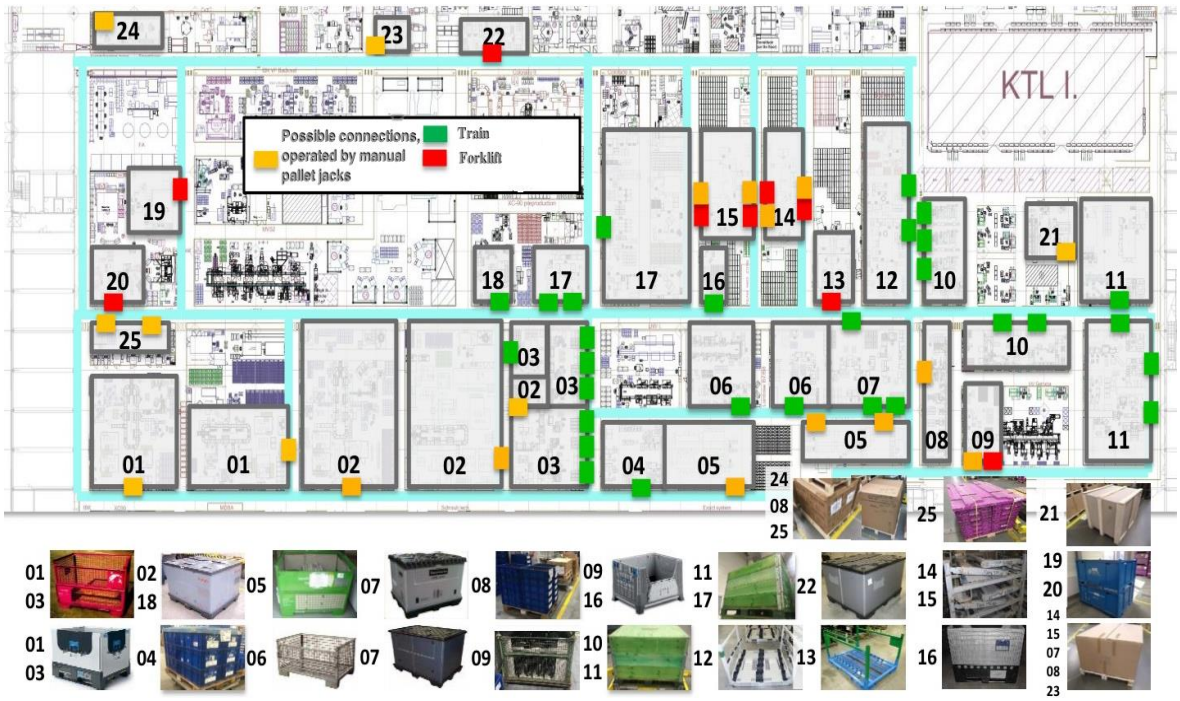

Figure 17: Work Stations with loading and unloading areas

Figure 2 gives a general view of what type of boxes are being used in each working station. Each box with ideal number represents the working stations, the color variation represents the type of transport machine used in each working station.

In our case, the areas with yellow boxes can be operated by the workers using manual pallet jacks, the size of boxes used are 115 x 100, standard ISO 120 x 100 or standard EUR 120 x 80, for example in stations 1, 2, 5 and 9, the trains and forklifts won't operate efficiently because the strapping machine is just few meters away from these working stations, a worker in these stations can use the manual pallet jacks to place the boxes directly to the waiting bay before a forklift places the box to the strapping machine, one manual pallet jack can deliver one box per trip.

The working stations with green boxes represents the loading and unloading of boxes for tugger trains which uses box size 124 x 83, ISO standard 120 x100 and, or EUR standard 120 x 80, tugger trains can transport 4-6 carts of boxes per trip.

The working station areas with red boxes represents the loading and unloading of boxes for forklifts, boxes handled by forklifts are bigger than the standard size used by tugger trains, measurement of bigger boxes in operation are 160 x 120, 165 x 120 and 150 x 120 ideally forklift machines can transport 1-2 boxes per trip, regardless of box size.

5.1.1 Types of transport machines:

Figure 18: Tugger Train

Loading capacity: 6 carts of boxes

Battery operated

Figure 19: Forklift

Loading capacity: 1-2 boxes

Battery operated

Figure 20: Pallet jack

Loading capacity: 1 box

All of these transport machines are ideal to be operated and used in final production floor as these machines are fast, durable, and easy to operate. Although most of these machines are also prone for malfunction so proper care and maintenance is required to make it operate efficiently as possible.

Figure 21: Standardized size pallets used together with box

6 WORKFLOW PROCESS

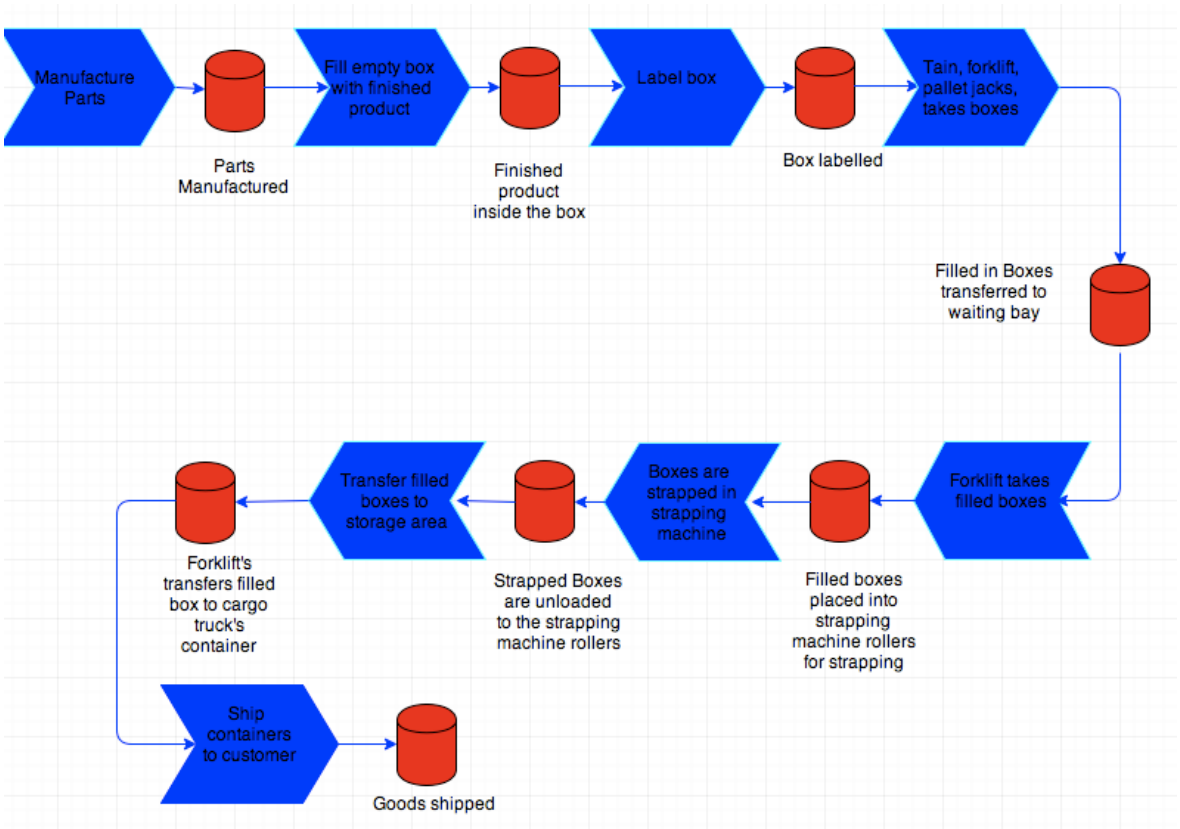

Figure 22: Workflow in final production area

The workflow process in Brose CZ s.r.o is quite interesting, it is a huge manufacturing area but the workflow of workers are not sophisticated as we perceive it to be. As shown in Figure 6, let me explain in detail the workflow process, starting of the parts needed are delivered to each working stations where they will be assembled by workers, after assembly workers will then fill the empty boxes with the assembled parts, afterwards these boxes are labeled with proper description of type of product and quantity. Depending on the work station area shown in previous page on Figure 2, these boxes are to be taken either by tugger trains, forklifts or pallet jacks and transferred to the waiting bay.

When the line of waiting bay is full, max of 3 rows, a forklift assigned in the area will take each box, approximately 2 boxes and place it on the strapping rollers waiting to be strapped by the strapping machine.

At the end line of the strapping machine area, another forklift is waiting to place the strapped box in the storage area, and soon after operation is complete, the boxes are placed to the containers where the cargo trucks are situated few meters away from the storage area.

7 TRANSPORT MACHINES

I have listed down key informations of transport machines used in distribution operation:

Type of transport machine	Tugger Train
Number of Trains	Four
Number of Train Operator	Four per shift
Operating hours	8 hours
Number of shifts	3 shifts per day
Number of breaks of workers	1st break – 10 minutes break 2nd break – 30 minutes lunch break

Table 1: Train specs

Type of transport machine	Forklift
Number of Forklift	Five
Number of Forklift Operator	Five per shift
Operating hours	8 hours
Number of shifts	3 shifts per day
Number of breaks of workers	1st break – 10 minutes break 2nd break - 30 minutes lunch break

Table 2: Forklift specs

8 SPAGHETTI DIAGRAM

Next part of my work will concentrate on the actual frequency of distribution for final products from working stations to waiting bay area, the strapping machine and storage area. This actual analysis identifies the exogenous problem of transport machines (tugger trains and forklifts) within the production floor.

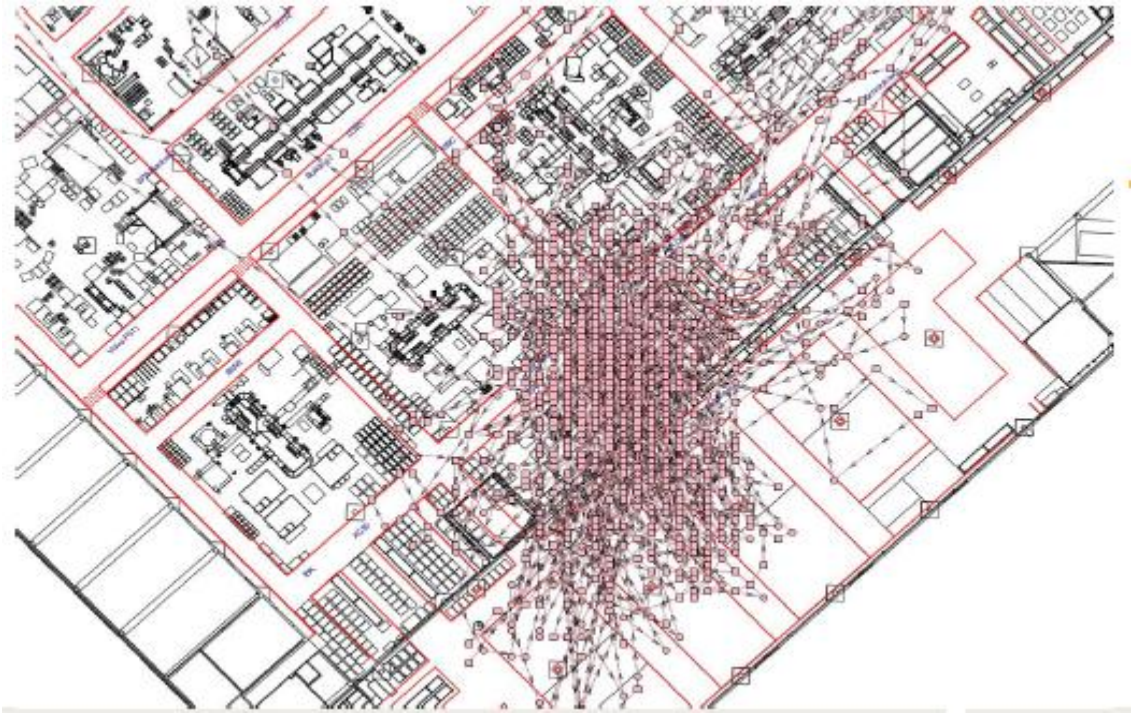

Figure 23: Transport movement #1 for finished goods

In this diagram the pink dots together with a line represents the routes taken by forklifts and trains, as you can see from this photo the continuous operation of 4 trains and 5 forklifts in workstations 2, 3, 4 and the waiting bay area, considering these transport machines using the limited space, these unplanned routes by train and forklift operators are staggering, the unplanned delivery operations can cause accidents between train and forklift operators which in effect causes delay of delivery thus creating bottleneck for the next operation. We can also assume that the operation demand for only one strapping machine per day is extremely high.

Operation Results:

Time of Analysis	10-12; 13-15
Number of observation days	3 days
Train plate numbers	1, 2, 3, 4
Forklift plate numbers	1, 2, 3, 4, 5
Work Stations	2, 3, 4, waiting bay area
Routes taken by train from point of origin to point of destination, vise versa	Random measurement, depends entirely on operator on which route to take.
Transportation flow of both tugger trains and forklift	From 4pm to 5pm there were 2 instances when trains 1 and 2 proceed to the same work station using different route to pick up filled in boxes, this confusion resulted to train number 2 to go back and check other work stations if boxes are ready to be transported to the waiting bay.

Table 3: Spaghetti diagram result #1

Products	Transport Machine	Duration	Day
A	Forklift #2	10 minutes	1 and 2
B	Forklift #1	12 minutes	1 and 2
C	Forklift #3	14 minutes	2 and 3
D & E	Forklift #4	15 minutes	2 and 3

Table 4: Delivery time duration result #1

Forklift operations are uncoordinated, there were instances for example that forklift #1 would take boxes from waiting bay area and unloads it to start point of strapping machine and goes directly to end point to take the strapped box and placed it to storage area. Normally there is a forklift operator assigned at the end point of the strapping machine to take the strapped boxes and placed them to storage area, and it was not the case during my

observation. It is noticeable that the forklifts are faster than the tugger trains and can be maneuvered easily, the forklifts operation is flexible and can deliver on time, but with this type of aggressive, uncoordinated work attitude with forklift drivers it would be uncommon not to have an accident from time to time, this type of working environment is an example of the 8 types of waste in lean management and 5's of lean six sigma.

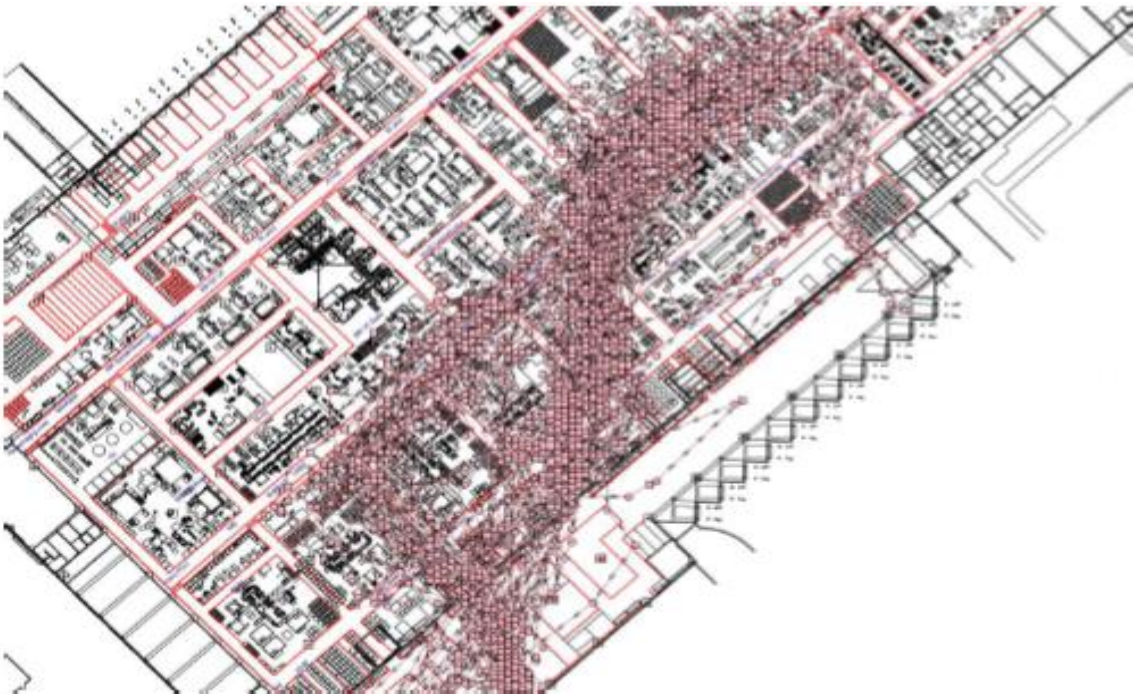

Figure 24: Transport movement #2 for finished goods

Another practical case from actual operation, in this diagram the pink dots together with a line represents the routes taken by forklifts and trains, as you can see from this photo the continuous operation of 4 trains and 5 forklifts in workstations 2 to 7, 12 to 18, the roads in between these stations is a stiff road approx. 8 meters wide, these diagram shows operations which are not in sync for a free planned movement of transport machines, the actions taken by train and forklift operators, perhaps can invite potential accidents during working hours due to unnecessary movements caused by unplanned routes and probability of delay in delivery from time to time is high, this type of operation also gives potential bottlenecks for the next operation like the operation of the strapping machine.

Results:

Time of Analysis	9 – 11; 15 – 17
Number of observation days	3 days

Train plate numbers	1, 2, 3, 4
Forklift plate numbers	1, 2, 3, 4, 5
Work Stations	2, 3 and 10-18
Routes taken by train and forklift from point of origin to point of destination, vise versa	Random measurement, depends entirely on operators which route to take, no planned tracks
Transportation flow of both tugger trains and forklift	From 9:30am to 11am there were 2 instances when trains 1 and 4 proceed to the same work station using different route to pick up filled in boxes, same goes to forklift operators 2 and 5 delivering empty boxes to work station 15 around 10:30 am, these confusion resulted to loss of operating time.

Table 5: Spaghetti diagram result #2

Products	Transport Machine	Duration	Day
A	Train #3	11 minutes	4 and 5
B	Train #1	10 minutes	4 and 5
C	Train #4	12 minutes	5 and 6
D & E	Train #2	10 minutes	5 and 6

Table 6: Delivery time duration result #2

Table 6 shows the completion time of delivery by trains from loading boxes in each working stations with finished products to the waiting bay area. There are noticeably drivers of trains and forklifts sneaking out the production floor area during working time for a stick of cigarette.

9 STRAPPING MACHINE AREA

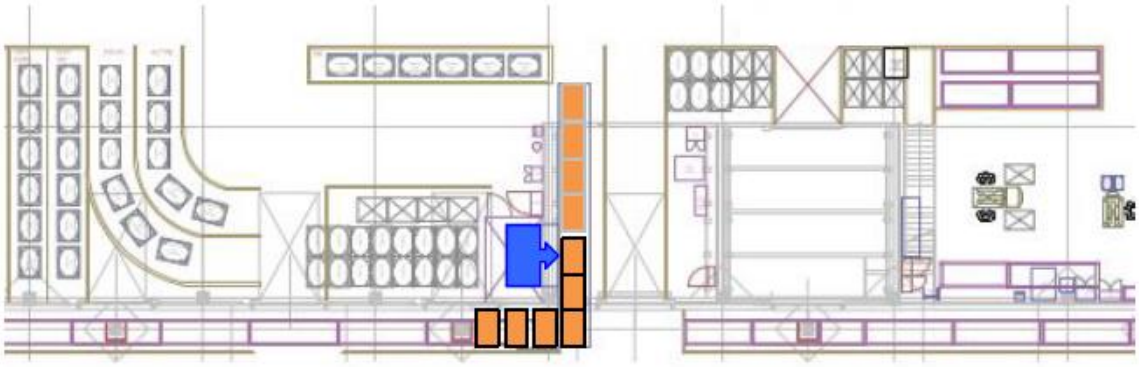

Figure 25: Strapping Machine (Blue Box)

Type of machine	Strapping Machine
Type of operation	Automatically set
Operating hours	24 hours
Number of days in operation	7 days
Number of strapping machine available in Production floor	1 machine
Total number of boxes operated in one year (2015)	541,229 boxes
Number of spare machine, if strapping machine breaks down	none

Table 7: Strapping machine information

Month	**Number of Boxes**	**Month**	**Number of Boxes**
January	39,452	July	50,253
February	38,340	August	50,824
March	46,616	September	74,459
April	41,835	October	78,908
May	47,980	November	77,882
June	56,536	December	46,389

Table 8: 2016 Forecasted production increase

Table 8 shows the current production and forecasted number of boxes that will be delivered to clients this year with a total of 649,475 boxes. The production of new car models of each car makers which will be introduced in the middle quarter of this year were used as reference for this forecast.

9.1 Waiting Bay Area

Figure 26: Waiting area for products A, B, C, D and E

Figure 11 shows the actual waiting area, as you can see these boxes are ready for delivery but it needs to be strapped in the strapping machine before the boxes are delivered to the customer.

This is the full capacity of the waiting area for the green boxes, 3 rows of yellow trailers:

1st Row	4 boxes
2nd Row	6 boxes
3rd Row	6 boxes
TOTAL	16 boxes

9.2 Operation

I have created a simple table chart to showcase the actual operation both in strapping machine and waiting bay areas and further analysis of the workflow operation:

FORKLIFT OPERATION	TIME
Forklift takes 2 filled boxes from waiting bay	1 minute and 10 seconds
Forklift unloads 2 filled boxes on strapping machine rollers	1 minute

Table 9: Forklift operation in waiting area and strapping machine

The forklift will carry 2 boxes at a time, where boxes will be taken from the first row in waiting bay and delivered to strapping machine rollers. In waiting bay area, after first row of yellow trailer is empty, a forklift will load the empty trailers with empty green boxes, when the yellow trailer is fully loaded with empty green boxes, a tugger train will hook up the yellow trailer from the waiting bay and deliver straight to the working stations that needs these empty green boxes for the replenishment of finished products.

9.3 Strapping Machine

Figure 27: Starting point of strapping machine

The front area of strapping machine where boxes are placed to be strapped, maximum of 6 boxes to be placed on the rollers

Figure 28: End point of strapping machine

Strapped boxes are taken out individually by a forklift to be placed in the storage area.

9.4 Strapping Operation

Number of box handled per operation	1 box
Time for strapping 1 box	20-25 seconds

Table 10: Strapping machine operation time

9.5 Analysis Evaluation

In this evaluation I am going to point out some waste I have noticed while analyzing processes in brose company. This analysis valuation and summary will serve as a reference for project optimization proposals.

9.5.1 Distribution of boxes with finished products

During the distribution process observation, I have noticed one major deficiency that adds to company's spending overtime. I have experienced bottlenecks during period of deliveries simply because the drivers of both tugger trains and forklifts doesn't have pre planned routes to take in order to get into their destination on time without delays, actions taken by the drivers to reach their individual destinations were only done by going through areas which are passable. The flow of information between drivers are not properly implemented. Some drivers drive fast, especially the ones handling the forklifts and drivers do cigarette breaks whenever they feel so of doing, regardless of time.

9.5.2 Visualization

Some areas in the production floor have fading colors of walk paths, this walk path is also vital for personnel or visitors who would have ocular inspection or visit to the production floor. Clear visualization is part of the 5's methodology which brings us closer to standardized working environment

9.5.3 Strapping Machine

There were records last year that the strapping machine malfunctioned due to maintenance issue, and it was fixed. However the amount of time was a bit long to change its broken parts. The current production rate is in high productivity, and this means the work of strapping machine 24hrs a day would even be more demanding, having one strapping

machine seems to be not ideal for the current rate of productivity especially when demand increases over time.

9.6 SWOT Analysis

In my SWOT analysis, individual strengths and weaknesses (Table 8), opportunities and threats (table 9) are all evaluated by percentage according to their importance.
The evaluations are base according to my perspective.

STRENGTHS	
28%	Worldwide Company image.
28%	Stability of company as manufacturer and employer.
22%	Modern technology and manufacturing process.
22%	Cooperation with Universities
WEAKNESSES	
35%	Greenhouse gas emissions
30%	Energy consumption
25%	Environmental burden
10%	Obsolescence of technology

Table 11: SWOT strength and weaknesses

The undisputed reputation of brose company within the automotive industry remains evident because of the management's consistent approach with its company's goal. Perhaps the impact of its production to the environment should also be taken into account with more sustainable and recreational programs to lessen its carbon footprint emissions each year, the production processes should also be in continuous improvement in order to maintain its overall competitiveness.

OPPORTUNITIES	
30%	Improving of processes in the company by employees initiative
30%	Financial support for modern technologies and higher employment
20%	New discoveries in automotive industry
20%	Growth of cars demand in automotive sector
WEAKNESSES	
30%	Low-cost competition in Asia
25%	Increasing environmental standards
25%	Higher taxes and other levies
20%	Tariffs quotas (economic barriers overseas)

Table 12: SWOT opportunities and weaknesses

brose company manufactures car accessories, and as demand for cars increases the production in brose also increases, this trend can significantly affect the success growth of brose both positively and negatively. The emphasis of quality in brose's products should remain at its highest to maintain loyalty with its famous clientele's and by doing so will cause a chain reaction through its satisfied end users. brose support for innovation should remain up beat to always stay on top of its products performance, however with external factors to affect profit such as tax increases and tariff quota's, these should also be taken into account strategically whenever introducing new products overseas.

10 PROJECT OPTIMIZATION PROPOSAL

A project proposal has been made to create project timeline in order to set time goals for the completion of this project proposal moreover it also suggests continuous improvement in the areas of final production where certain wastes have been found that contributes to the inefficiency of overall work.

10.1 Project Responsibility Matrix

The purpose of this matrix is to identify specific task assigned to specific person for the whole duration of the proposed project.

Task	Project Manager	Operations Manager
Manage project team	R, A	C, I
Budget	R, A	C, I
Direct and manage project work	R, A	C, I
Manage stakeholder engagement	R, A	I, A
Risk audits to ensure that every new and crucial risk is identified	R, C	R, I
Setting up the rules and regulations	R, A	C
Financial operations	R, A	I, A
Measure according to project management plans	R, A	C, I
Perform financial closure of the project	R, A	I
Report final project performance	R, A	A, I
Documentation of the project	R, A	R, A

Table 13: Responsibility matrix

Meaning	This Person Is
Responsible	Responsible for performing the task or creating the document
Accountable	Accountable and has sign-off authority for the task, such as the project manager, sponsor, technical lead
Consult	Providing expertise, advice and support to the person responsible for the task
Inform	Informed of task progress or results, usually by the person responsible

Table 14: Categories for assigning responsibilities

A good rapport between Project Manager and the Operations Manager ensures that all rules are being implemented and all actions are dealt with accordingly without lapses of judgment on both sides. This Responsibility matrix is just an example on how important tasks can be divided to each responsible person involve in order to deliver the tasks on time and finish the project as it was scheduled.

10.2 Logical Framework

Objectives	Success Measures	Verification	Assumptions
Overall objective (Goal)	Enhance existing logistic processes in brose company	Analysis of previous year production	
Project purpose (Outcome)	a. 20% increase efficiency in box distribution of final products b. Minimize travel time of tugger train and forklift operation c. Additional strapping machine to offset the load	Active Participation of donors, Operations Manager and Workers	Free flow in distribution of boxes and strapping of boxes containing finished products.

	of strapping machine 1		
Results	Organized distribution of finished products means doing the right thing at the right time	Records of previous year performance will verify the consistency of the proposed new project	No undesired activities, reduced bottlenecks, reduced unnecessary movements in production area
Activities	1. 4 Additional Trains 2. 5 Additional Forklifts 3. 1 Additional strapping machine 4. 6 extra batteries 5. Enhanced workflow process 6. Path optimization	(1) 8,860 euros per train (2) 6,645 euros per forklift (3) 36,282 euros (4) 2,215 euros per battery Total cost: 98,302 euros	Final production area operation enhanced by 10-15% and can work efficiently with a 20% increase in demand

Table 15: Logical framework

In logical framework, I listed down the most important part of the project proposal, with all the necessary add-ons for number of machines, equipment and processes, the current demand and future demand increase in brose's products will be operated efficiently by the new project being proposed.

10.3 Value Stream Analysis

1. Below is the current workflow process in brose's production area.

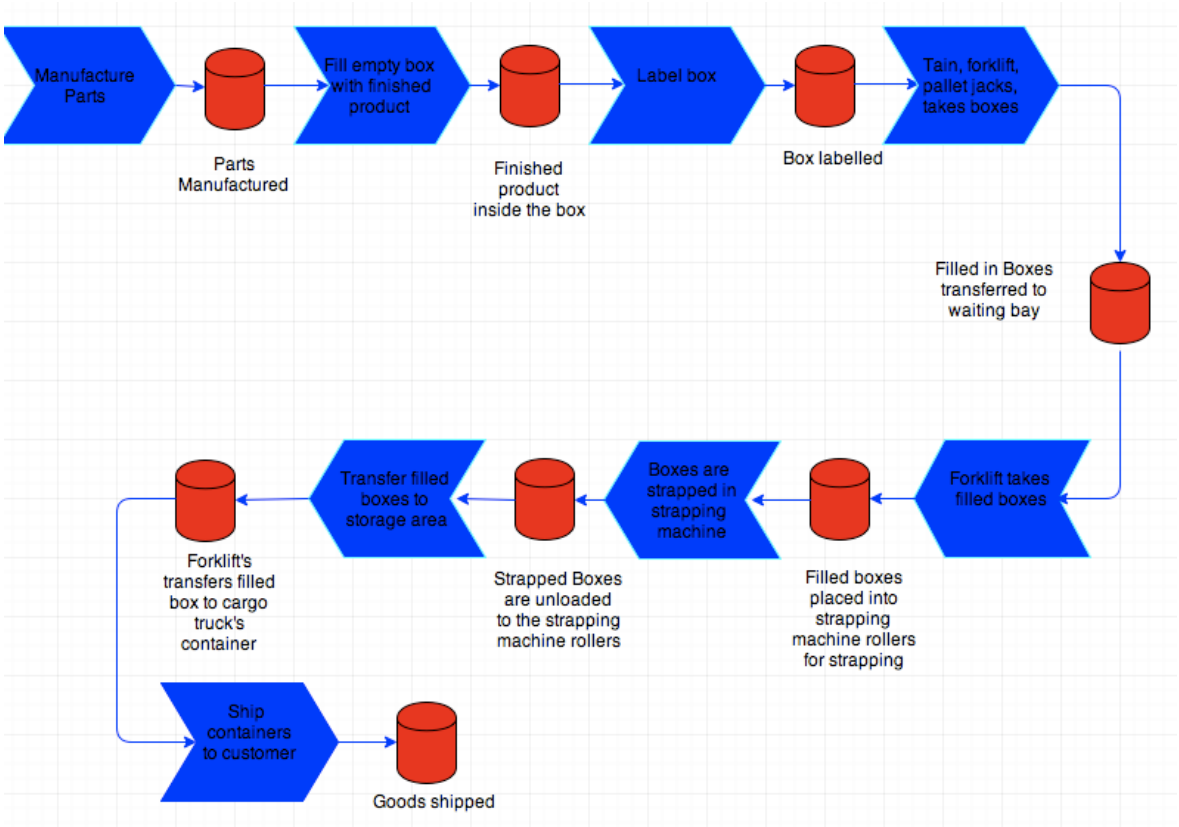

Figure 29: Current Workflow Process

In the current workflow, this is the general view of workflow process of operations in brose, in this step we can identify processes which adds value to the company's products and services, and also identify other process which gives lesser or non value to its products and services.

2. Processes which creates value to brose's products and services

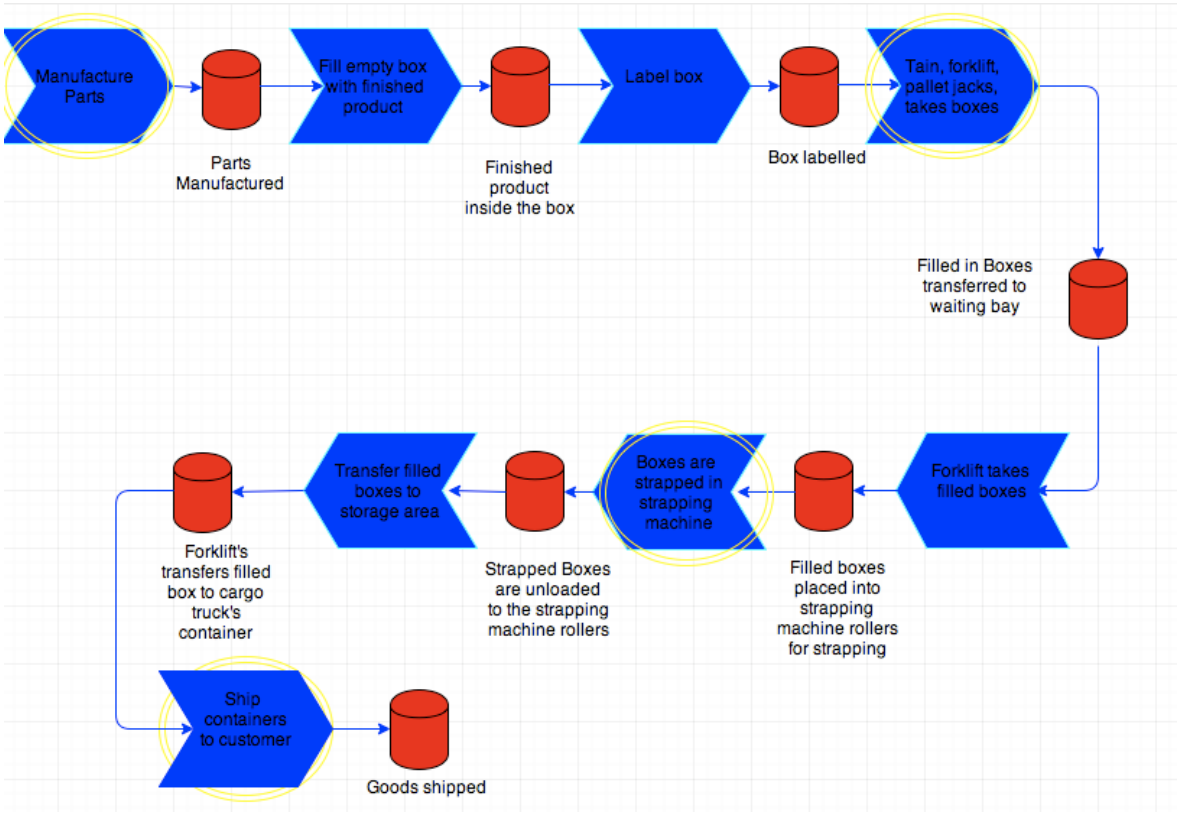

Figure 30: Important Processes

In figure 29, I selected the the processes which are important on the whole workflow, this is crucial so that we can proceed on the next phase where we would eliminate the processes which are not important or doesn't create value to brose's products and services.

3. Identifying the processes which creates less value

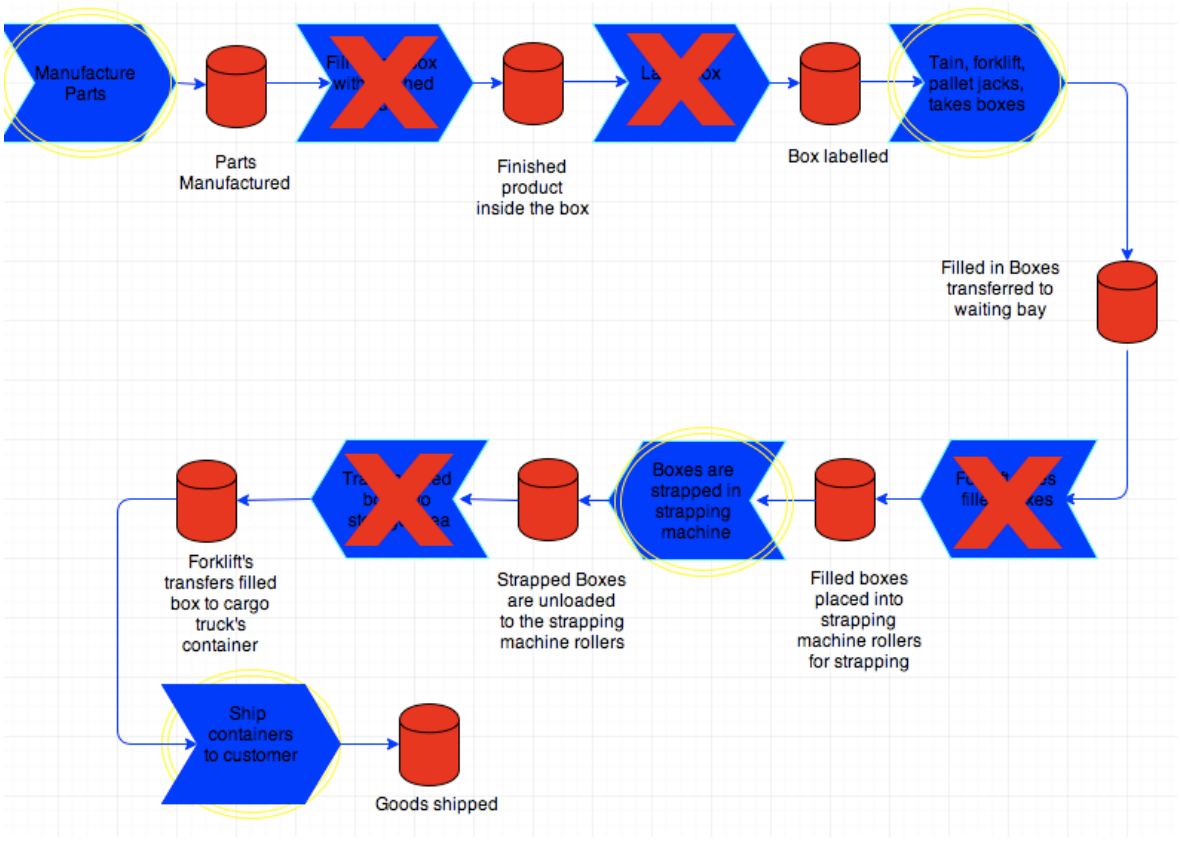

Figure 31: Less Important Processes

Since we already have identified the important processes in the whole workflow, I also identified the processes which creates less value to brose's products and services, as this processes somehow prolongs the operations in distribution of final products thus creating unnecessary movement and time. Now we can proceed to the final step.

4. Combine all the important process

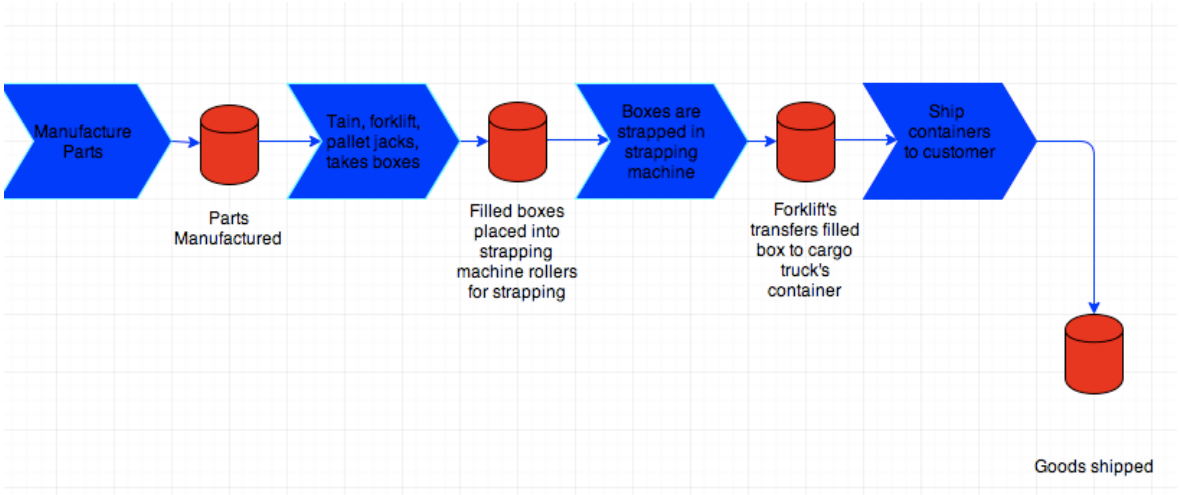

Figure 32: Improved Process

Here I combined the processes which are important. This will give managers an overview of comparison between the current process implemented in production and the new and improved process, this new process can provide the company efficient and effective production performance. It is great importance to understand that this improved process serves as an edited process, now new process was added, simply we only eliminate the process which I find does not create value in brose's products and services.

10.4 Visualization

Figure 33: Unclear Walkpath

Not all areas in production area have visible walk path. Walk path areas in between the main entrance until storage area needs to be re–painted. It is certain that all employees knows the production area very well The problem is that according to safety regulations, this unclear path could cause a problem during up coming audit visits.

10.5 Path Optimization

The goal of path optimization is to eliminate unnecessary movements and to promote standardization of lean management in the final production area.

Product A

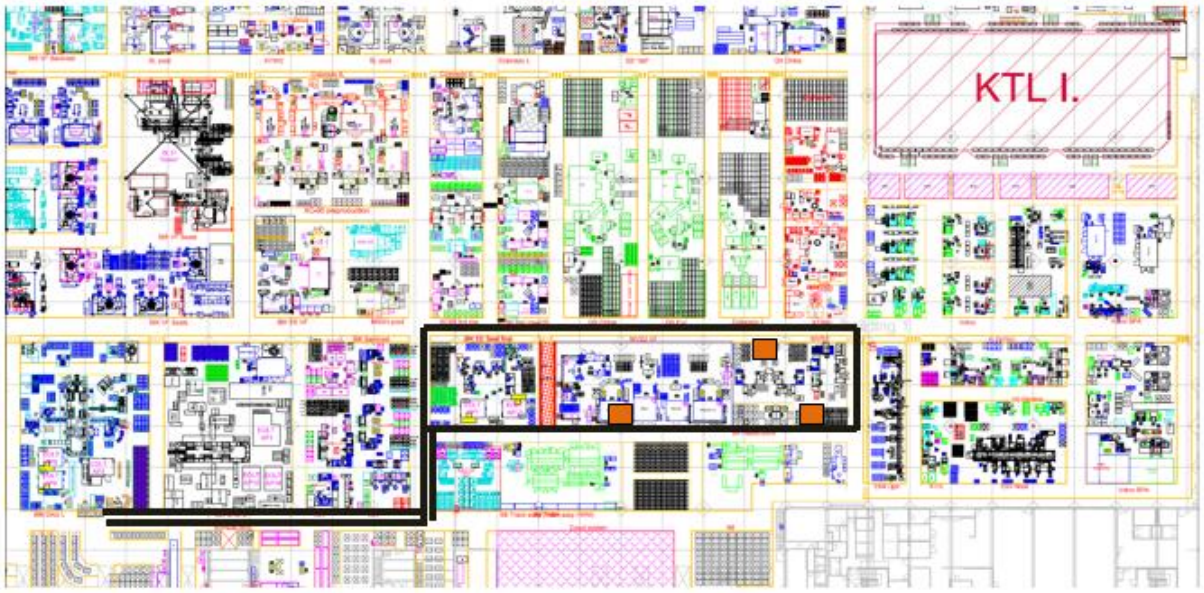

Figure 34: Train Route A

Train 1

Place for finished production

Type removal of finished products:	☒ Train ☐ Forklift VZV
Summary serviced projects:	Product A
Length in meters:	345 m
Frequency per hour:	5 boxes / hour 1 route = 6.8 min with a 15% margin (5.9 min without reserve)
Note:	1 Train capacity

In connection to the spaghetti diagram, this project optimization proposal will eliminate unnecessary movements from both truck and forklift drivers. In optimization map on Product A, a path was designed specifically to have the fastest travel time to reach both area of origin to area of destination. 1 train to service this area per hour

Product B

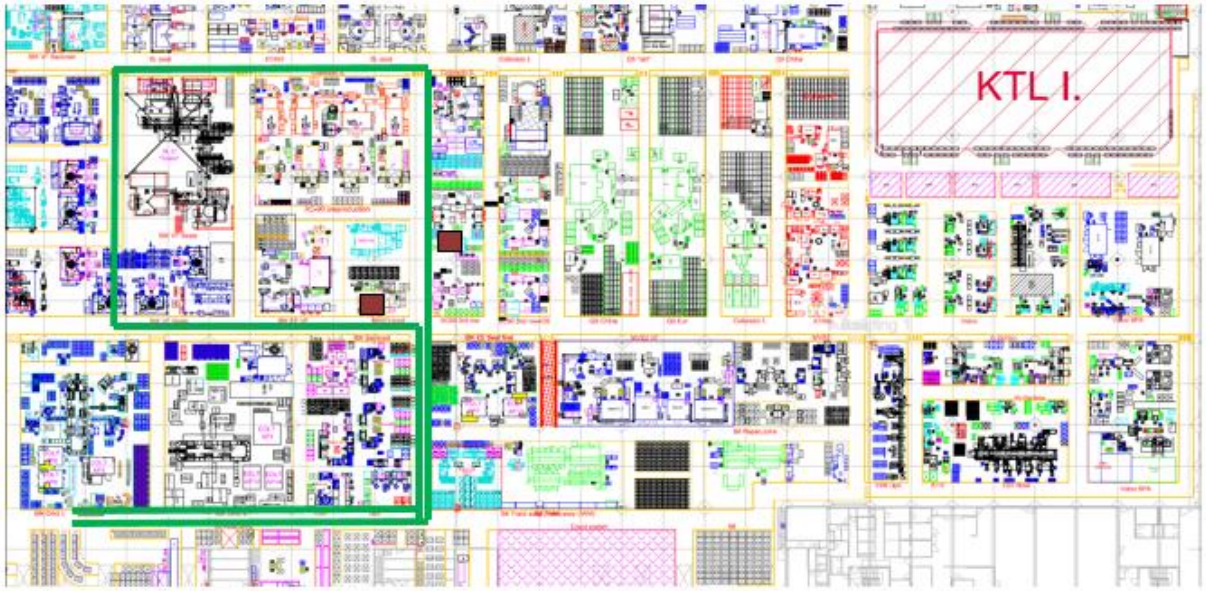

Figure 35: Train Route B

Train 2

Place for finished production

Type removal of finished products:	☒ Train ☐ Forklift VZV
Summary serviced projects:	Product B
Length in meters:	360 m

Frequency per hour:	18 boxes / hour 1 route = 8.51 min with a 15% margin (7.4 min without reserve)
Note:	3 train capacity

In the proposed path for Product B, this will cater the demand for several trucks in one operation, the working stations needs at least 3 trains to deliver 18 boxes into the strapping machine per hour. The overall time to complete one successful delivery from the point of loading 18 boxes with finished products to the strapping waiting bay area is 8.51 min.

Product C

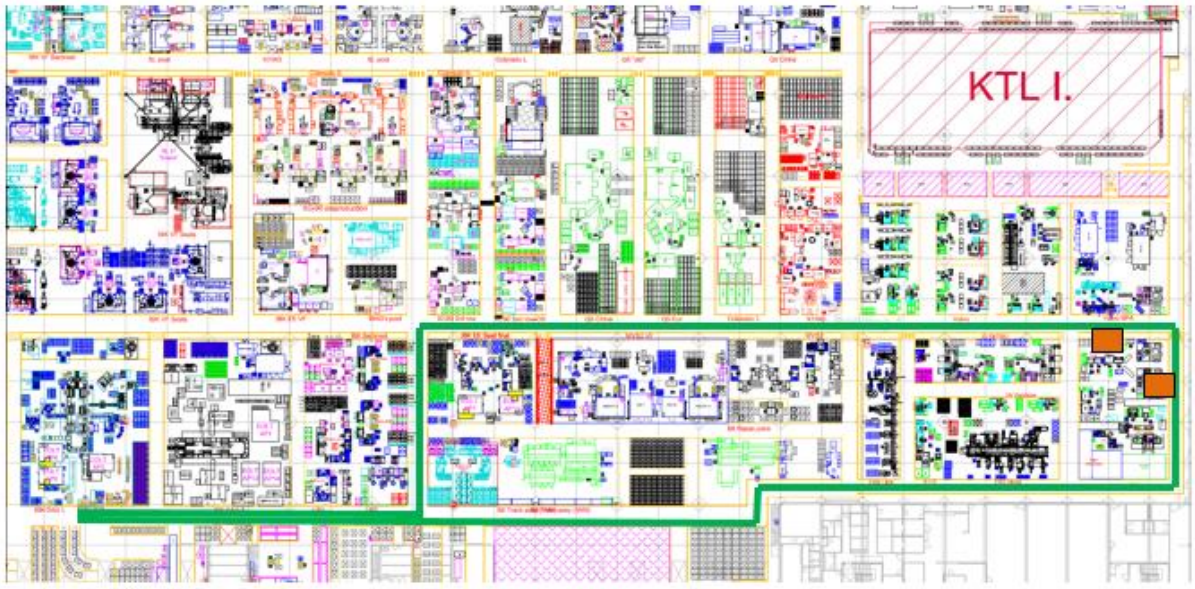

Figure 36: Train Route C

Train 3

Place for finished production

Type removal of finished products:	☒ Train ☐ Forklift VZV
Summary serviced projects:	Product C
Length in meters:	490 m
Frequency per hour:	6 boxes / hour 1 route = 6.99 min with a 15% margin (6.09 min without reserve)
Note:	1 train capacity

For Product C route, the time for one tugger train to complete one successful delivery will only take 6.99 min.

Products D and E

Figure 37: Train Route D and E

Train 4

Place for finished production

Type removal of finished products:	☒ Train ☐ Forklift VZV
Summary serviced projects:	Product D and E
Length in meters:	230 m
Frequency per hour:	16 boxes / hour 1 route = 7.2 min with a 15% margin (6.3 min without reserve)
Note	Number of trailers: 6

For 6 trains to load 16 boxes of products D and E per hour, this path offers an effective travel time of 7.2 min per train.

Findings:

The current number of tugger trains in final production area are 4 operational trains, these are used 24 hours. With regards to the frequency of box delivery of Products A-E per hour, the 4 trains are not sufficient enough to be effective in meeting the demands of its delivery service, that is why an additional 4 trains will be ideal to decrease the inefficiency of delivery service that promotes bottleneck in the final distribution area. By adding 4 more trains, the work in production will reach be 90%

10.6 Additional Strapping Machine

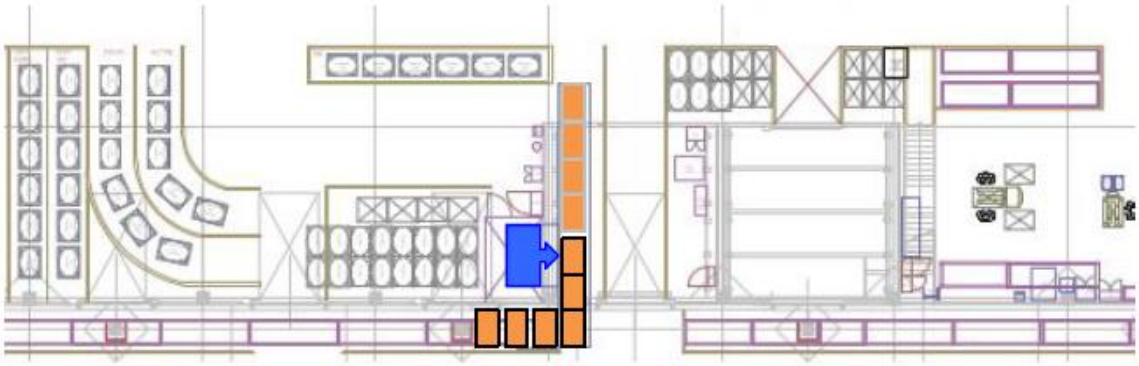

Figure 38: Current Strapping Machine

Reasons for inactivity of the strapping machine

	Period of Inactivity
Jam on runway	00:18:45
Unproductive time	00:41:47
Bundling machine has a malfunction	00:01:06
Sensors have malfunction	00:01:17
Band Strapping Is empty / is replenished	00:05:22
	01:08:17
Recording time	**19/02/16 – 26/02/16 (10-11;15-16)**

Findings:

- Strapping capacity is in full capacity, saturation level of operation has been met, there will be an increase of bottleneck when customer demand increases in the coming years.
- Overloading contributes to malfunction of strapping machine
- Strapping machine straps all finished products produced, this means there are other products being strapped for overseas delivery that is not included in Products A B, C, D and E.

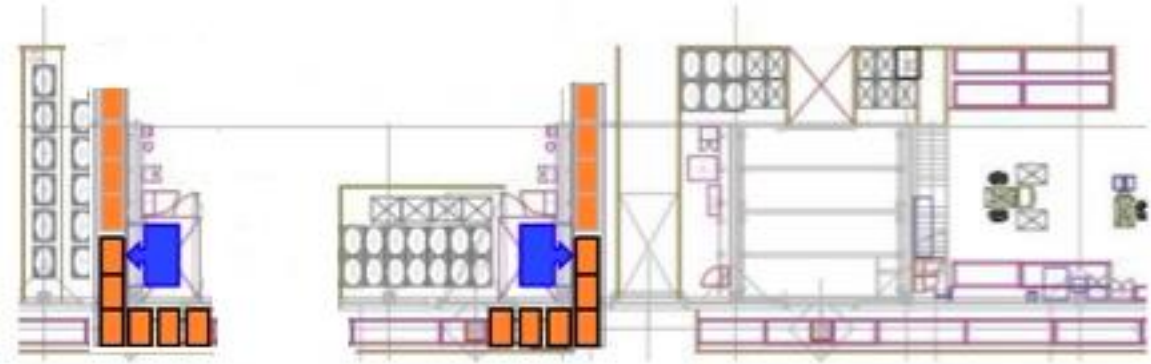

Figure 39: New Additional Strapping Machine

A new strapping machine is proposed to offset the operation problem due to overload from the first strapping machine, this will also enable to decrease the inactivity period which was recorded on the time of observation. In addition the waiting bay area has been occupied and replaced by the proposed additional strapping machine to further utilize not only the space but to substantially add value to brose's products and services. An additional machine enables the final production area to be more effective in eliminating bottlenecks for final distribution.

10.7 Cost Analysis

Here is the assessment of the potential cost of the project

Description	In Euros
Electric Tugger Train (4pcs)	8,860.00 per train
Electric Forklift (2pcs)	6,645.00 per forklift
Additional train battery (4 pcs)	2,215.00

Additional forklift battery (2pcs)	2,215.00
Industrial strapping machine	36,282.00
TOTAL	98,302.00

Table 16: Cost analysis

The total expected expenses for this project proposal will be 98,302.00, the most expensive price per piece is the industrial strapping machine, however in consideration with the number of pieces ordered, the orders for tugger trains is the most expensive. The budget for project proposal will solely be decided by the managers and procurement department of the company, as the company is self sufficient on funding projects with its own retained earnings.

10.8 PEST Analysis

Political:

- Tax policy
- Employment laws
- Environmental regulations
- Trade restrictions and tariffs
- Political stability
- Pricing regulations
- Industrial safety regulations

With brose's locations around the globe, these political factors including government regulations and legal issues, formal and informal rules under which brose company must comply with to operate will remain to be a challenge for business performance.

Economic:

- Interest rates
- Exchange rates
- Inflation rates
- Labor costs
- Economic growth

These economic factors affect the firm's cost of capital and purchasing power of potential customer.

Social:

- Culture
- Education
- Demographics
- Population growth rate
- Age distribution

These social factors are external macro environment which the company has no control, thus the company should always take into consideration these social factors to ensure customer satisfaction and create customer loyalty.

Technological:

- Research and development
- Automation
- Technological development
- Technology incentives

Technological factors can reduce efficiency in production level, therefore research and development is always a good investment for continuous improvement by creating added value in brose's products and services.

10.9 Risk Analysis

Type of Risks:

	Risks	Cost	Time	Impact
1	Delivery Problems	High	High	High
2	Malfunction of machines	High	High	High
3	Soft skill issues	Medium	High	High
4	Lack of funding	Medium	Medium	High
5	Non participation of some members in the project team	Low	High	High

Table 17: Risk analysis

During the start and end date of the project, there are risks involved that will affect the consistency of the planned completion of the proposed project. A Project Manager must have good soft skills because this is the key for cooperation between the project team, thus creating a healthy working environment means all work is done properly through good communication, everybody understands what the project goal is all about, on the other hand when both managerial and soft skill are not properly given by the Project Manager, there is a high risk for some team to postpone its own job and commit mistake with the job because of lack of motivation especially when the Project is complicated and has a small timetable for completion. Risk on lack of funding will be frustrating for everyone involved in the project, first for the stakeholders because this means the problem of daily inefficiency in the production will remain as the required number of trains and forklifts to mitigate the increase of bottlenecks in production area still hasn't been resolved. For the new machines, delivery problems such as customs issues is also a high risk, proper documentation of these products should always be correct, if not done correctly, the risk of delays in delivery will cause high impact in the project. After delivery, machines are operated, however there is also risk there will be some machines that will not work due to factory defects, we all know all of these machines are covered by warranty's, but the time it takes to replace these machines will take days and since brose operates 24 hours a day, this type of risk will cause high impact in production.

10.10 Analysis of current and forecast data

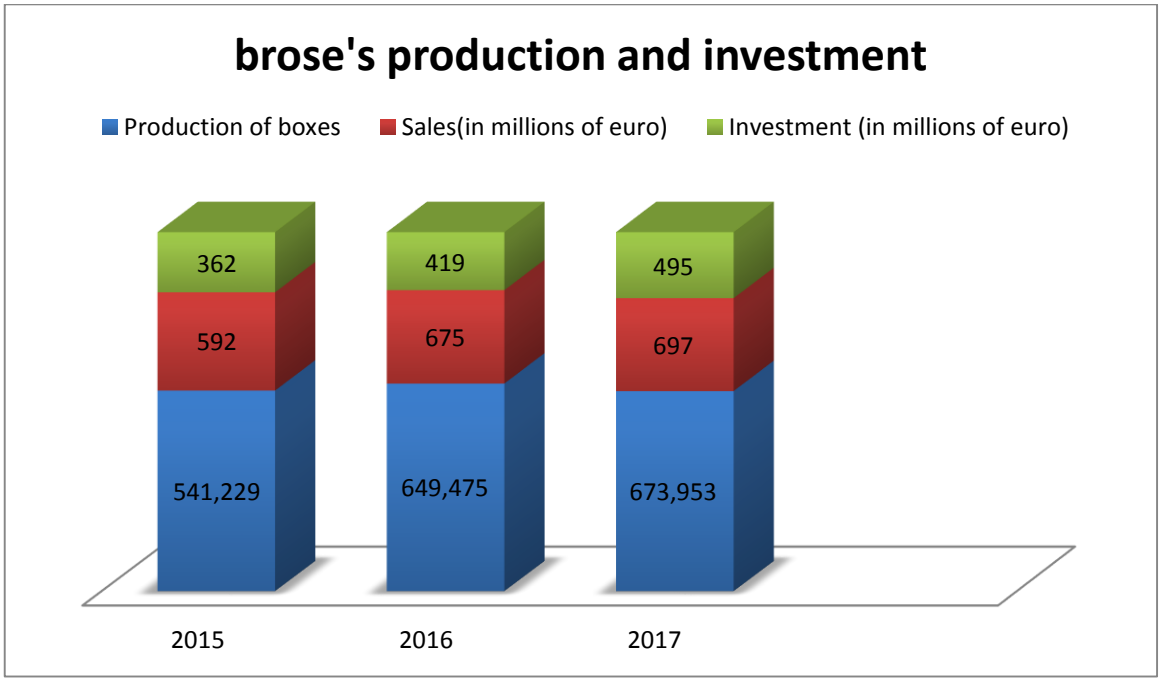

Figure 40: Financial and Production Analysis

Table 18 shows the current boxes sold each year and a forecast of increase in production by 2017, from 2015 to 2016 there has been a huge increase of production by 16% while the forecast estimate for 2017 is at 18%.

The sales continues to rise up from 2015 to 2016 with 14% projected turnover. While on the next year the estimate increase will only be at 3%.

brose CZ s.r.o. is self funded company which takes 8% of its revenue fully invested in research and development, the financial support of this project will be taken from this special fund. Percentage Increase formula was used in data interpretation and analysis.

Percentage Increase Formula:

$$\text{Percentage Increase} = \frac{Final\ Value - Initial\ Value}{Initial\ Value} x\ 100$$

10.11 Project Milestones

	Milestones	Predecessor	Working days
A	Project planning		7
B	Meeting with stakeholders	A	3
C	Discussion of plans	B	5
D	Introduction of new team members	A	5
E	Assignment of tasks	B, C	3
F	Discussion of risks	B, D	5
G	Approval of funds from procurement department	B, C	3
H	Order of equipment and machines	B, G	7
I	Invitation for bidding	G, H	7
J	40% down payment of equipment and machine orders	G	3
K	Delivery period of orders	G, I	14
L	Implementation of path optimization	C, E	7
M	Hiring of construction service with another company	G	7
N	Reconstruction of waiting bay area to strapping machine 2 area	G	10
O	Arrival of new equipment and machines	G, I	7
P	Installation of new equipment to strapping area 2	N	5
Q	Implementation of project	E, F	7
R	Project end	P	3

Table 18: Project timetable

Project milestone is a time analysis of the duration of project, this milestones are guide sets in order to fulfill the end time or completion of the project.

CONCLUSION

My master thesis is focused primarily on the implementation of efficient changes in distribution and logistics processes in brose CZ s.r.o. The company is no doubt a success within the industry it serves, apparently the company also realized that staying on top caries more responsibility to maintain competitiveness. Modern organizations that use different kinds of process optimization tools, realize the need for quality improvement and waste reduction techniques. Using the Six Sigma principles with consistency guarantees a secured and productive operation in the company. IT technology has obviously been a major trend of focus recently by companies and brose isn't the one lagging behind but among the first to have state of the art technology around the globe.

In my observation period in brose production, I have analyzed logistical processes to identify inefficiencies. First part of my proposal includes the enhancement of workflow process as the current process posses some flaws which doesn't give value to brose's products and services, it was enhanced to eliminate some processes which only add more cost to the company than contributing for the company to save and generate more revenue. Another part of my proposal are the additional train and forklifts in the production floor area, this is to mitigate the increasing demand of production in the coming years, as of today the 4 trains and 5 forklift delivers 80% efficiency in the whole production floor, reoccurring bottlenecks is one obvious testament to this problem and unnoticed illegal breaks committed by its drivers during working hours. Part of the optimization proposal is reducing the time period of deliveries by path optimization, which makes the train operation organized and the planned routes per work station suggests earliest time to finish one delivery.

The last part of my optimization proposal focuses on elimination of bottlenecks in the final distribution area which relies highly on strapping machine performance. The current 1 piece strapping machine operating in brose is not efficient to handle the influx of boxes. Machines are also susceptible for product degeneration overtime, and the strapping machine is not immune for this deterrence. The strapping machine experience bottlenecks whenever the carton boxes from overseas (china) are produced at the same time with the boxes delivered all around Europe, in addition for every break down of machine caused by malfunction, in every one hour delay - 50 boxes are already waiting to be strapped. The

only solution for this problem is to add another strapping machine, taking over the area of waiting bay so as to use productively the extra space.

The cost of my proposal will be taken from the funds funded by brose itself through its research and development department, it will take one to two months before achieving any improvement in performance. Once the Project Manager starts to achieve some initial improvement in performance, performance in brose's final production area will improve at a high rate, presumably at 20% increase in comparison to the current performance, and lower the unwanted cost brought to the company by work inefficiency. This research is dedicated to the improvement of logistics process in brose CZ s.r.o

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Online Resources:

[21] http://www.softwareag.com/Corporate/res/books/bpm_for_dummies/default.asp

[22]http://collaborate.adsroot.itcs.umich.edu/mais/projects/psmprcimpmethdev/Shared%20Documents/Lean%20Six%20Sigma%20Continuous%20Improvement%20Roadmap.pdf

[23] http://www.bpmnstyle.com

[24] http://www.ims-productivity.com/page.cfm/content/Work-Measurement/

[25] http://www.leanprocess.net/what-is-lean-six-sigma/

LIST OF ABBREVIATIONS

Approx. Approximate

LIST OF FIGURES

LIST OF TABLES

APPENDICES

Appendix I: Result of PERT method for activities in brose new project

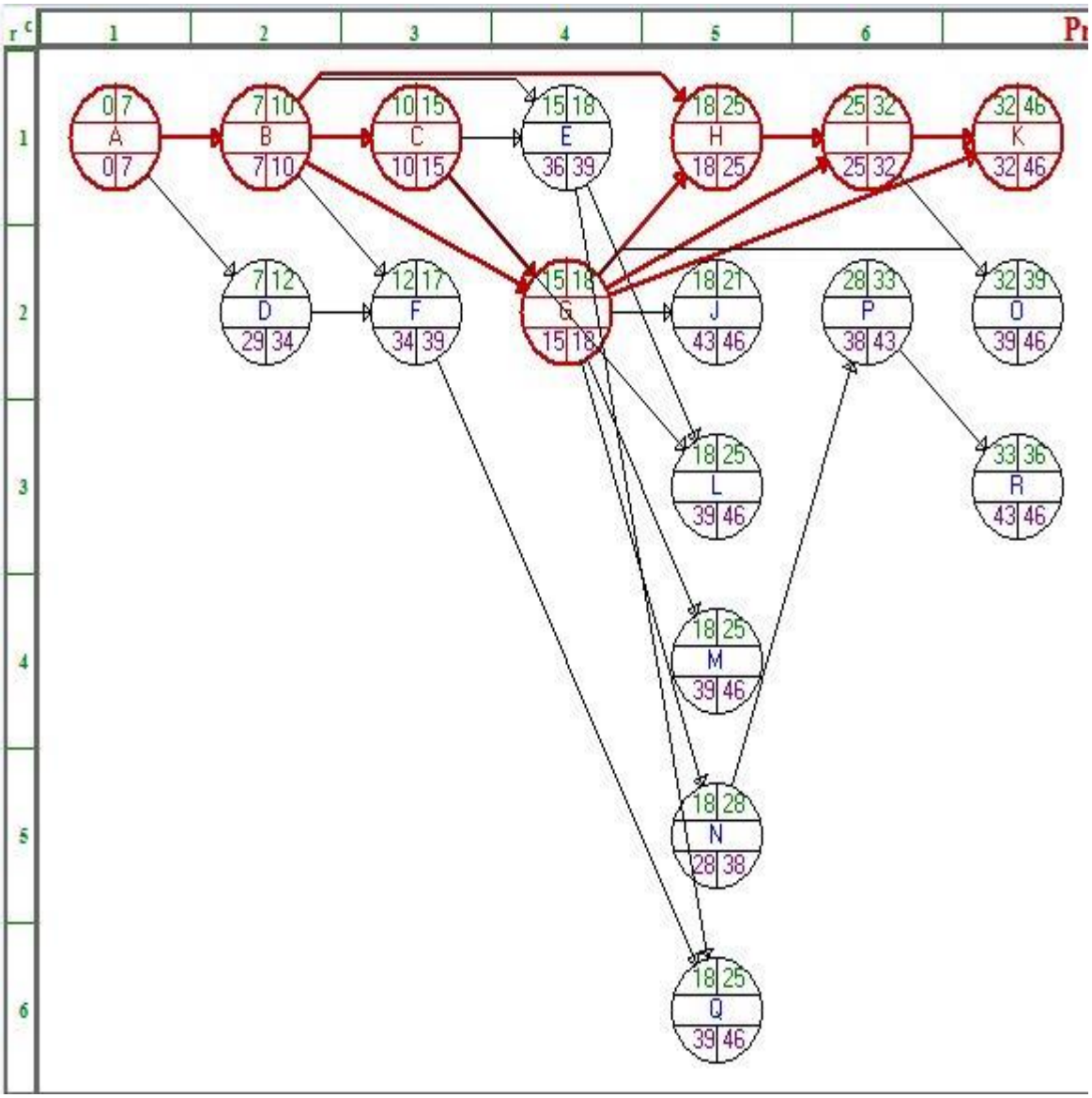
Appendix II: Graphic solution for brose new project

Appendix III: Gantt chart solution for brose new project

APPENDIX P I: RESULT OF PERT METHOD FOR ACTIVITIES IN BROSE NEW PROJECT

04-25-2016 11:23:35	Activity Name	On Critical Path	Activity Time	Earliest Start	Earliest Finish	Latest Start	Latest Finish	Slack (LS-ES)
1	A	Yes	7	0	7	0	7	0
2	B	Yes	3	7	10	7	10	0
3	C	Yes	5	10	15	10	15	0
4	D	no	5	7	12	29	34	22
5	E	no	3	15	18	36	39	21
6	F	no	5	12	17	34	39	22
7	G	Yes	3	15	18	15	18	0
8	H	Yes	7	18	25	18	25	0
9	I	Yes	7	25	32	25	32	0
10	J	no	3	18	21	43	46	25
11	K	Yes	14	32	46	32	46	0
12	L	no	7	18	25	39	46	21
13	M	no	7	18	25	39	46	21
14	N	no	10	18	28	28	38	10
15	O	no	7	32	39	39	46	7
16	P	no	5	28	33	38	43	10
17	Q	no	7	18	25	39	46	21
18	R	no	3	33	36	43	46	10
	Project	Completion	Time	=	46	DAYs		
	Number of	Critical	Path(s)	=	7			

APPENDIX II: GRAPHIC SOLUTION FOR BROSE NEW PROJECT



APPENDIX III: GRAPHIC SOLUTION FOR BROSE NEW PROJECT