DOKUZ EYLÜL UNIVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

IMPLEMENTATION OF KAIZEN BLITZ APPROACH IN AN ELECTRONICS FIRM

by
Hafize ÜNALAN

March, 2009
İZMİR

IMPLEMENTATION OF KAIZEN BLITZ APPROACH IN AN ELECTRONICS FIRM

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M.Sc THESIS EXAMINATION RESULT FORM

We have read the thesis entitled **"IMPLEMENTATION OF KAIZEN BLITZ APPROACH IN AN ELECTRONICS FIRM"** completed by **HAFİZE ÜNALAN** under supervision of **PROF. DR. G. MİRAÇ BAYHAN** and we certify that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.

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Hafize ÜNALAN

IMPLEMENTATION OF KAIZEN BLITZ APPROACH IN AN ELECTRONICS FIRM

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In this thesis implementation of the Kaizen Blitz approach, known as one of the principles of the total quality control applications and lean manufacturing, in an electronic company is presented.

First, problems faced by the company before the execution of this approach are defined, and then implementation steps and expected improvements that will result from carrying out the Kaizen Blitz approach are given in detail.

Keywords: Kaizen Blitz, Total Quality Control, Lean Manufacturing.

KAİZEN BLİTZ YAKLAŞIMININ BİR ELEKTRONİK FİRMASINDA UYGULAMASI

ÖZ

Bu tezde yalın üretim ve toplam kalite kontrol uygulamalarının prensiplerinden biri olarak bilinen Kaizen Blitz yaklaşımının bir elektronik firmasındaki uygulaması sunulmaktadır.

İlk olarak, bu yaklaşımın yürütülmesinden önce firmanın karşılaştığı problemler tanımlanmış ve sonra uygulama adımları ve Kaizen Blitz yaklaşımının tatbik edilmesinden sonra beklenen iyileştirmeler detaylarıyla verilmiştir.

Anahtar Sözcükler: Kaizen Blitz, Toplam Kalite Kontrol, Yalın Üretim.

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CHAPTER ONE
INTRODUCTION

1.1 Introduction

Total Quality Control is a management technique and work understanding to find the customer current and future requirements and to meet these requirements economically and completely with continuous improvement. Kaizen is a customer driven strategy for continuous imrovement. Kaizen involves a system approach and problem solving tools to meet customer requirements and to provide better products at lower costs. The objective is to use innovative thinking to eliminate non-value-added work. Kaizen involves looking at the current state of a process, separating value-added from waste and making it right by using Lean principles to leaving out the waste and rebuilding a better process. To do this value stream mapping is useful tool to see the whole value stream with production and information flows and to find value added and non value added operation.

Kaizen Blitz is the fast and dramatic form of improvement, it is a highly focused improvement process aimed performance improvements in a short time, in narrowly targeted areas. In a typical Kaizen Blitz project, a cross-functional team work to rapidly develop, test, and refine solutions to problems and leave a new process in place in just a few days. Kaizen Blitz is used by teams across the world to rapidly and dramatically improve quality, productivity, on-time delivery, safety, inventory, changeover times, and overall flow of work.

This thesis presents continuous improvement and Kaizen by focusing Kaizen Blitz. The objective of this thesis is analysing the tools and the methods of Kaizen Blitz projects. For the analysis a Kaizen Blitz Project is conducted in an electronics firm. After the implementation we analyse the benefits and the results of Kaizen Blitz.

1.2 Organization of the Thesis

This thesis can be divided into four main chapters. Chapter one contains a brief description of the Kaizen and Kaizen Blitz. It also describes the scopes of the study.

In Chapter two; Continuous Improvement and Kaizen are introduced, the benefits of Kaizen are analysed. Then the explanation of Kaizen Blitz is given. The tools to make Kaizen Blitz are described in this chapter.

Chapter three presents an application of Kaizen Blitz in the real business environment. For the application company presentation is made. After that the problem is stated and the project is analysed deeply. At the end of this chapter the results of the Kaizen Blitz project and the improvements on the selected area are presented.

Conclusion and future directions are presented in Chapter four.

CHAPTER TWO
KAIZEN METHODOLOGY

2.1 The Definition of Kaizen Methodology

The KAIZEN is a Japanese concept adapted from the world and recognised by Toyota Production System (TPS). It is a combination of two words:

KAI: change
ZEN: good and for the better

Kaizen is defined as improvement. It is a philosophy of continuous improvement that should be considered in everyday life, not only at work, but at home, on a production line or in an office. When applied to the workplace Kaizen means continuing improvement that involves all employees from executives to laborers, and the managers in between (Kaizen Guide,nd,2007).

Improvement can be broken down between Kaizen and Innovation. Kaizen means small improvements, but Innovation is a drastic improvement as a result of large investments in new technology or equipments. Kaizen can not replace innovation. The two are complementary. Ideally innovation should take off after kaizen has been exhausted, and Kaizen should follow as soon as innovation is initiated (Imai,1986).

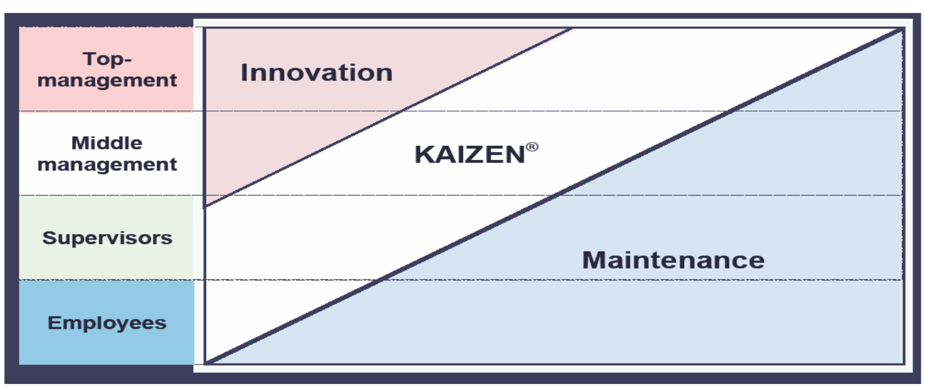


Figure 2.1 Japanese perceptions of job functions

Kaizen is an umbrella concept covering most of practices. The kaizen umbrella covers many of the management techniques that have been developed, including quality circles, total quality control, total productive maintenance, suggestion systems, kanban, just-in time, productivity improvement, Zero Defect, robotics and automation (Imai,1986; Wittenberg,1994).

Figure 2.2 Kaizen umbrella

The properties of Kaizen Events are:

- Widely applicable – They can be used in both manufacturing and non manufacturing environments.
- Team based & cross functional – Team members can be from various functions of the business. Top management participation is encouraged.
- Planned & tied to business goals – Events are planned in advance and tied to business goals and or value streams. Planning is critical to the success of the event.
- Focused in scope – Events are very focused, we should not take too much on at one time.

- Short term, fast and iterative – Events last approximately two to five days. Even though the process has gotten better you may have to repeat events on the same process. This is continuous improvement process.
- Based on Implementation – Events are biased to action. We should plan our events on doing.
- Highly effective & results oriented – Kaizen events will generate quick and measurable results. We should establish the baseline and measure the change.

2.2 The Benefits of Kaizen

The benefits of Kaizen are obvious to those who have introduced it to their companies. It allows us dramatic improvements in productivity, quality, delivery, lead-time, set-up time, space utilization, work in process and workplace organization. Kaizen leads to improved quality, greater productivity and better morale.

Kaizen helps lower costs and lets management become more attentive to customer needs because it creates an environment that takes customer requirements into account.

Kaizen supports continuous improvement approach for:

- Health and Safety
- Quality
- Efficiency
- Material & information flows (to reduce motion or transportation wastes)
- Surfaces
- Ergonomics
- Office: Marketing, finance, purchasing, logistic etc.
- Optimizing a Value Stream Map
- Identifying opportunities for improvement
- Reducing inventory and WIP
- Reducing overall cost

- Lead time
- Optimal use of peoples' skills
- Customer service and customer satisfaction
- Employee participation
- Reduction in rework (Kosandal & Farris, 2005)

The role of Kaizen Activity Groups is to identify opportunities for improvement within business processes (Toyota,2002).

Two main opportunities for improvement are:

- The elimination of Muda (waste) from processes
- The correction of any issues and problems within processes in addition to Muda.

Monden (1993) suggested a new scheme of classifying operations into three generic categories as non-value added (NVA), necessary but non-value added (NNVA) and value added (VA).

Muda is waste and non-value added activity. Muda is represented by all types of waste in a process inclusive of conveyance (movements), waiting, redundancy, overburden, unevenness and correction, rework amongst other things (Toyota,2002). It can be found at any time and in any place. It can be hidden in policies, procedures, process and product designs, and in operations. Muda consumes resources but does not add any value to the product (Seth&Gupta,2005). In lean there are seven types of wastes, they can be seen in figure 2.4 (Womack&Jones,1996).

Incidental work is non value added work which is necessary under present working conditions or required by law or regulation.

Value added work is value added job operations that customers desire and are willling to pay for or any activity that increases the market form or function of the product or service. To be value added a job should add form feature, or function to the product or service and enable a competitive advantage for example reduced price, faster delivery, fewer defects.

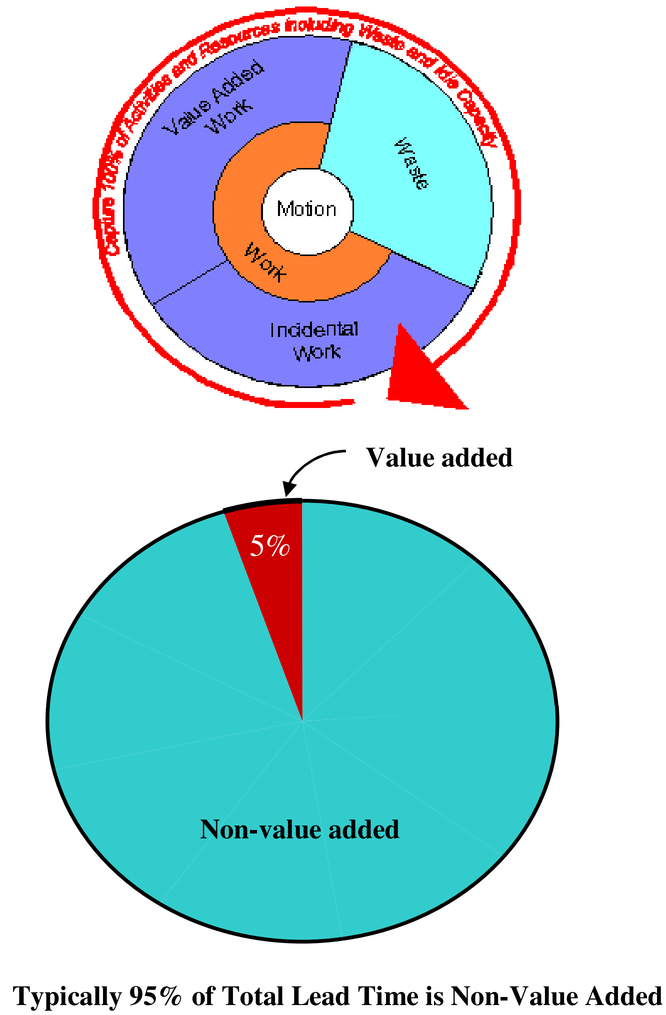


Figure 2.3 Types of wastes

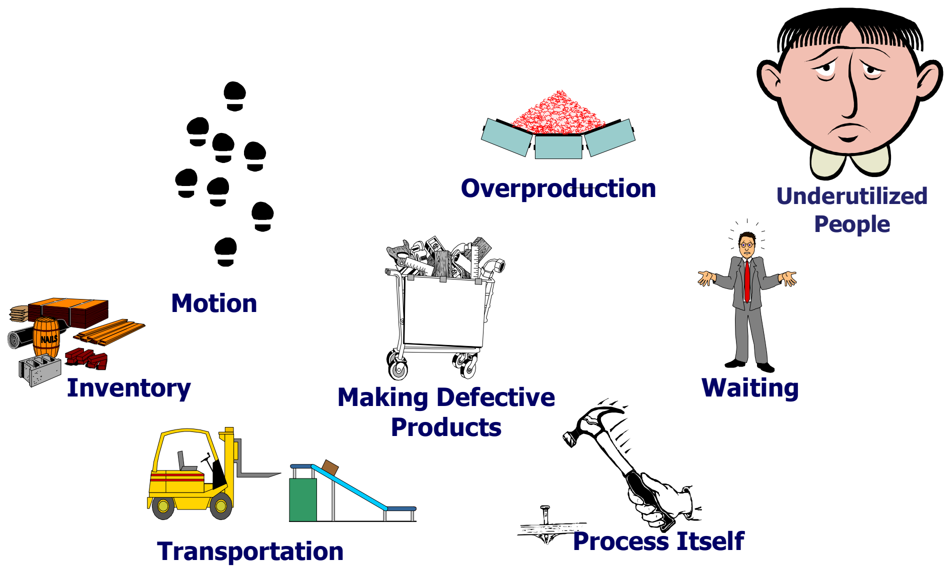


Figure 2.4 (Seven + one) typical wastes in production systems

- **Over-production Waste** – It occurs when products are produced at a faster rate than is required. Causes may be a lack of communication, anticipating demand, poor scheduling and production management. Over production causes all kinds of waste not only excess inventory and money. It requires storage space, handling, people, equipment and rework. Overproduction results in shortages, because processes are busy making the wrong things and it also lengthens the lead time, which impairs our flexibility to respond to the customer requirements.

- **Excessive Inventory Waste** – It is any inventory that is more that what the customer ordered. Inventory that sits in storage areas waiting for an order is a waste of material, money tied up, and the use of valuable factory space.

- **Time Delays Waste -** Machine wait time or human wait time contributes to waste within a company.

- **Transportation Waste** – It is such as unnecessary handling or movement of materials, numerous storage areas, and excessive moving equipment.

- **Processing Errors** – They are wastes that occur during the process manufacturing stage. They can be human error, machine-caused defects or quality problems.

- **Corrections/Defects/Rework Waste** – It is the time it takes to correct, inspect, scrap or rework is a major waste that must be avoided.

- **Excess Motion Waste** – It is any unnecessary human bending, reaching, walking or movement during a manufacturing process is a waste such as looking for tools and material too far from work areas (Krar,2007).

- We can add one more waste. The eighth one is the most important one, this is underutilized people. We should take the advantage of employees skill and experience and employ them in an efficient way.

2.3 Kaizen Blitz

Kaizen Blitz is a combination of the Japanese word Kaizen for "continuous improvement" and the German word Blitz for "lightning". It means lightning fast improvement (Brown,2004). The Kaizen Blitz originated from the 'jishuken' or "autonomous study" workshops conducted by Taiichi Ohno and his Toyota Autonomous Study Group. The companies in the Autonomous Study Group would take turns hosting these one-week long rapid improvement activities. These study groups, were led by Taiichi Ohno, the architect of the Toyota Production System. The Kaizen Blitz was introduced to the world by Norman Bodek, who during his 60 trips to Japan over the past 20 years met and translated the works of most of the Japanese kaizen masters. Norman met and worked with both Taiichi Ohno and Shigeo Shingo, and when members of Ohno's Autonomous Study Group formed the Shingijutsu consulting company, Norman brought them to the United States. Their approach to rapidly transforming an area of the factory is called 'Kaizen Blitz'.

Kaizen Blitz is treated more as a “Project” and not as an open-ended “Process”. It is a focused, typically up to a week long project where a cross-functional team reviews a process, identifies and eliminates waste, takes immediate action to improve a specific process, thereby achieving dramatic and tangible break through rather than incremental improvement. The analysis must be conducted by a team, to optimize value-added time. This team should include operators and any other relevant support staff (maintenance, methods engineering, logistics, quality, etc.) (Lee P.E,1994).

The whole directional pull for Kaizen Blitz comes from:

- Internally – from senior management through corporate and business goals and objectives to process operators
- Externally – from our customers and through market research (Toyota,2002).

Kaizen Blitzes help our organization become competitive in the way it makes and delivers its products and services through the expenditure of little money in a very short time. Kaizen Blitz is a low-cost project. When teams are charged with demonstrating and implementing changes to live processes in three to five days, there is no time to spend money on new capital equipment, complex and expensive tooling, or elaborate systems solutions (Imai,1997).

2.3.1 Kaizen Event Teams and Rules

Kaizen is a humanistic approach, because it expects everybody to participate it. It is based on the belief that every human being can contribute to improving his workplace, where he spents one third of his life (Leede & Looise).

For Kaizen Teams;

- 4-10 member is typical,
- We should get the people who know the process,
- We should include people working in the process and ask for volunteers first,
- Others with specialized knowledge are helpful,

- One member can be an impartial outsider with little knowledge about the process, who can question everything.

Top Management	Middle Management and Staff	Supervisors	Workers
Be determined to introduce KAIZEN as a corporate strategy	Deploy and implement KAIZEN goals as directed by top management through policy deployment and cross-functional management	Use KAIZEN in functional roles	Engage in KAIZEN through the suggestion system and small-group activities
Provide support and direction for KAIZEN by allocating resources	Use KAIZEN in functional capabilities	Formulate plans for KAIZEN and provide guidance to workers	Practice discipline in the workshop
Establish policy for KAIZEN and cross-functional goals	Establish, maintain, and upgrade standards	Improve communication with workers and sustain high morale	Engage in continuous self-development to become better problem solvers
Realize KAIZEN goals through policy deployment and audits	Make employees KAIZEN-conscious through intensive training programs	Support small-group activities (such as quality circles) and the individual suggestion system	Enhance skills and job-performance expertise with cross-education
Build systems, procedures, and structures conducive to KAIZEN	Help employees develop skills and tools for problem solving	Introduce discipline in the workshop	
		Provide KAIZEN suggestions	

Figure 2.5 Hierarchy of kaizen involvement

One note of caution is that team members should not expect to get their normal jobs done during a Kaizen Blitz. The kaizen activity is a full-time job, often lasting late into the night in order to implement the changes in five days.

There are some rules for Kaizen Blitz events, the team should be aware of this rules and the team leader should impose these rules on the team. Kaizen Blitz Rules are:

- Be open to change,

- Stay positive,
- Speak out if you disagree,
- See waste as an opportunity,
- No blame environment,
- Treat others as you want to be treated,
- Ask the silly questions, challenge the givens,
- Creativity is before capital,
- Understand the data and principles,
- Discard fixed ideas, reject current practices,
- Think about how to do it, instead of why it cannot be done,
- Act immediately on improvement suggestions,
- Do not seek perfection, achieve 60% of your target right away,
- Correct errors immediately,
- Turn problems into ideas,
- Seek root causes: ask "why" 5 times,
- Seek the wisdom of 10 people, rather than wait for one person to have a great idea,
- Put to the test, and then validate,
- Acknowledge that there is infinite potential for improvement.,
- The most important company assets are the people,
- Evolution of processes will occur by gradual improvement rather than radical changes,
- Improvement recommendations must be based on statistical and quantitative evaluation of processes,
- Just do it. (AME,nd)

There can be resistance to the Kaizen Blitz. The team leader should overcome the team's resistance. Possible roadblocks are:

- Too busy to study it
- A good idea but the timing is premature
- Not in the budget

- Theory is different from practice
- Isn't there something else for you to do?
- Doesn't match corporate policy
- Not our business – let someone else analyse it
- It's not improvement – it's common sense
- I know the result even if we don't do it
- Fear of accountability
- Isn't there an even better way?

2.3.2 The Deming Wheel For Ongoing Improvement in Kaizen Blitz

Providing a structured format for all Kaizen Activity Group activities, the adoption of the Plan, Do, Check, Action (PDCA) cycle is applied. The integral part of the Kaizen strategy is to systematically follow a cyclical channel of developing and delivering continuous improvement.

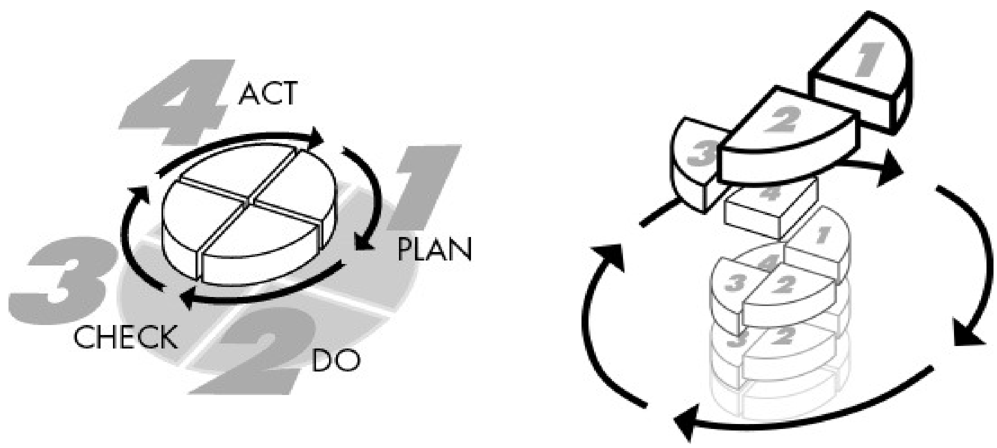


Figure 2.6 The deming wheel

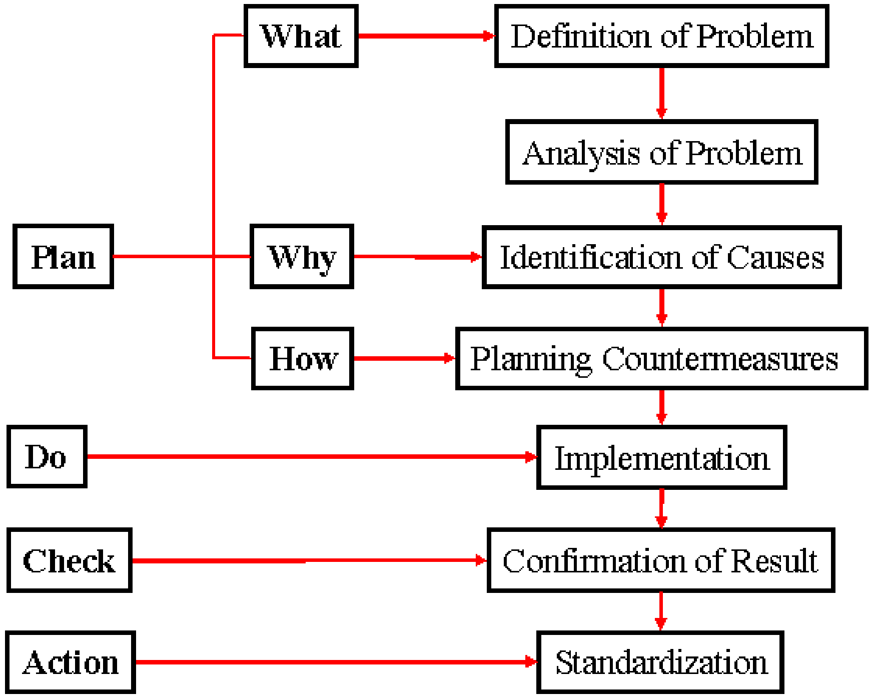


Figure 2.7 Problem solving cycle

The PDCA cycle is a series of activities pursued for improvement.

1 Plan

The Planning stage is the initial stage where multiple activities occur to truly identify:

- What the problem is
- Why it is occurring
- How to correct it

Management commitment to the performance improvement policy, and planning of related objectives. It begins with a study of current situation, the data is gathered to be used in formulating a plan for improvement. The reasoning for planning is to identify the root cause of an issue.

Plan What – Definition of Problem and Analysis of Problem

Plan Why – Identification of Causes

Understanding "why" a problem has been caused is a key aspect in understanding what countermeasures can be produced to correct the situation. When asking why, we do not stop at the first response. We ask "why" 5 times. Asking "why" 5 times will result in a more in depth answer and understanding as to the root cause. Methods that support the analysis:

- Pareto diagrams,
- Cause and effect diagrams,
- Histograms,
- Control charts.

Plan How – Planning Countermeasures

The goal of developing countermeasures is to solve the root cause of a problem with little or no capital expenditure.

2 Do – Implementation

The Do part of PDCA is where the implementation of all that has occurred during the planning process happens. After the plan, it is Implemented. For both the whole job function and the processes, the Do's come from:

- Immediately recognised improvements and countermeasures
- More detailed and analysed improvements and countermeasures

3 Check – Confirmation of Results

The Check is the measurement of the Do. Verification and evaluation of results and progress, the implementation is checked for improvement. This means that the countermeasures implemented must be measurable. If they are not, there has been a failure in the planning section. As is understood, if you can not measure it, it is not worth doing (Toyota,2002).

4 Action – Standardisation

Where the results are satisfactory, finalising the Kaizen Activity Group activity is required. The following areas need to be completed:

- Maintaining performance to constantly improve the process.
- Changes are implemented throughout the company where the processes are undertaken.
- Resources are reallocated to either the increase in value added work or elimination of Muda.
- Changes are documented into Policy and Procedure.
- Changes are documented into updated Process Maps.
- All stakeholders and staff affected are advised of the changes.
- Kaizen Activity Group finalise the action plan.

There can be no improvement where there are no standarts. There must be a standart of measurement for every worker, every machine, every process and every manager. For kaizen standarts exist only to be superseded by better standarts. Management must review the current standart and try to improve it. Once the standart has been established, mananegement must make sure all employes observe it strictly (Imai, 1986; Toyota,2002).

THE IMPROVEMENT CYCLE

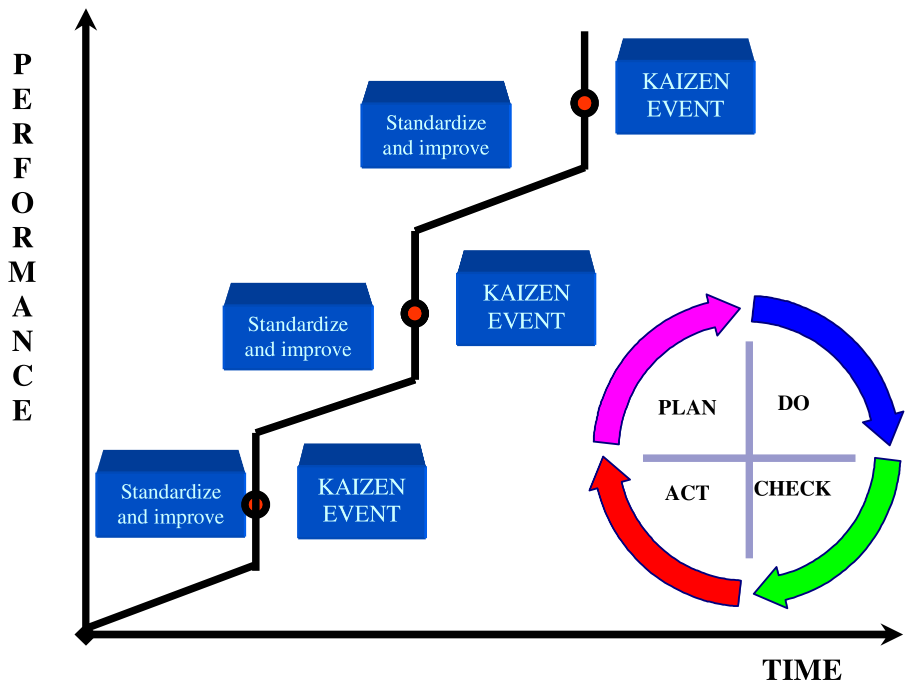


Figure 2.8 PDCA cycle

2.3.3 How To do Kaizen Blitz

2.3.3.1 Kaizen Blitz Steps

–We should begin planning 3-4 weeks in advance.

–Choosing the area.

–Selecting event dates.

–Selecting and asking team members.

–Team makeup 6–8 members

•4 core people –doers of the function or workers of the area being blitzed

•1 support person, 1 internal supplier, 1 internal customer

•1 outside eyes

–We should select people who do the work in the targeted area with:

•Process knowledge

•Specific skills in area

•Informal Leaders

•Influential skeptics

•Someone with “something to gain”

–We should assure availability of key people involved with the process, (who are not on team), during Blitz (Engineering, Maintenance, Purchasing etc.)

–Clear goal statement in advance is important.

–Communicating Kaizen to the rest of the organization 1 week in advance (Lean Manufacturing Solutions,nd).

–And Than Selecting a bottleneck situation in Value Stream Map.

–Understanding the “Current State” of the bottleneck.

– Drawing a process flow chart.

– Identifying whether each activity add value.

– Analysis cause of non-value added activities.

– Eliminating non-value added activities.

– Brainstorming the “Future State” to set improvement goals.

– Implementation within the five days.

– Then using the 30 day opportunity log to finish up any items requiring more time (Brown,2004).

2.3.3.2 Kaizen Blitz - Agenda

Day 1: Setting the scene and Day of Learning

- Meeting with the team, receiving training

Day 2: Observation the current process, Going to Gemba

- **Identifying the Customer:** Value added is always determined from the customer’s perspective. Who is the customer? Customers can be external customers and internal customers. External customers are final customers. Every process is the customer of previous process. This is internal customer. We can see the organisation in figure 2.9 (Imai, 1986). Every process should be focused on adding value to the customer. Anything that does not add value is waste.Some non-valued added activity is necessary waste. ("NVA-R") It can be regulatory or legal. Non value added activities should be eliminated to meet customers expectations and to increase customer satisfaction.

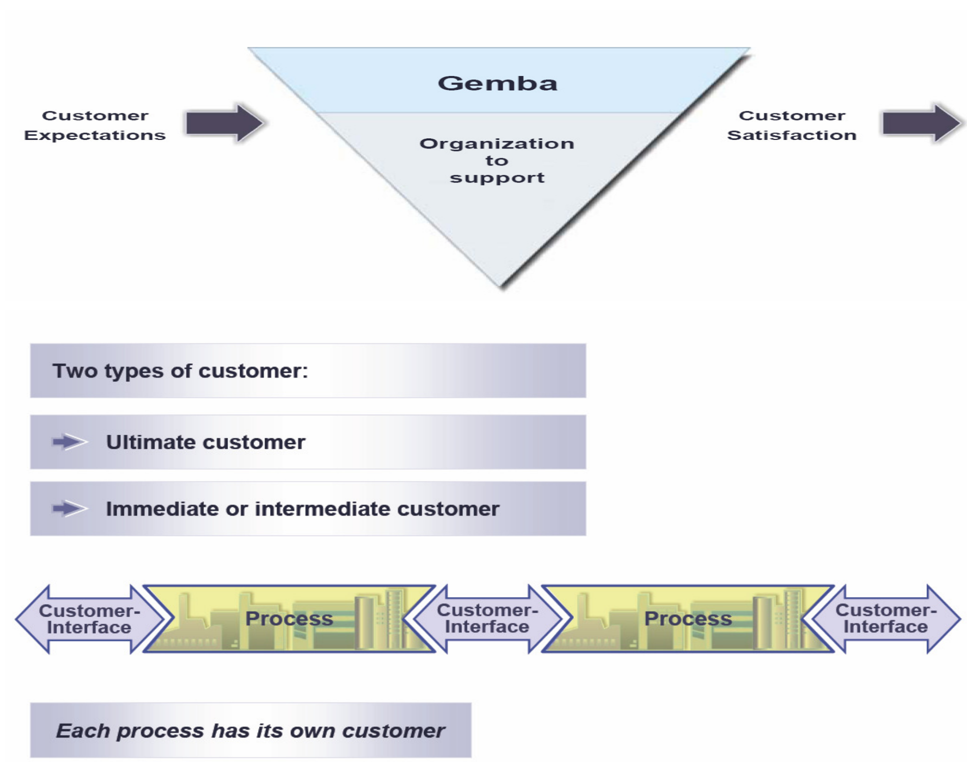


Figure 2.9 The customers and organization for kaizen

- **Identifying the Current State :**

- This step is crucial first step in process improvement.
- Deep understanding of the existing processes and dependencies is necessary.
- Identification all the activities currently involved in developing a new product is necessary.

- The team should observe the process first hand.
- The team should identify Value Added (VA), Non-Value Added Required (NVA-R), and Non Value Added (NVA) activities.
- For idenfication of the Current state the team should draw flowcharts, identify waste, identify root causes, walk through target area, map out the process, review data, calculate takt time, perform a 5S, spend full day for observing the process and use spaghetti diagrams, time observation forms, standard work combination sheets, video, etc.
- Generally this step creates more questions than answers.

Some Data for Identifying The Current State are:

Product Data :

- Product families,
- Quantity per family (History),
- Seasonality curve,
- Distribution of the past orders,
- Forecasted quantities for next 3 years ,
- Product BOM (bill of materials),
- FMR Analysis for the components,
- Assembly routines with useful time and non value added times,
- Cost breakdown per product family,
- Number of defective parts,
- Layouts and Areas,
- Shooting of the movie of the operations.

Indicators :

- MTM time per operation, IE validate , UT
- WIP stocks,
- Assembly time, Takt time, Cmax,
- Actual NQC & MDR .

Logistic :

- Parts per workstation,
- FMR Analysis for the components.

Some Tools for Identifying The Current State are:

- Flow Charts
- **Cause and Effect Diagrams:** The Cause & Effect diagram is a tool for discovering all the possible causes for a particular effect. Causes are arranged according to their level of importance or detail and it results in a depiction of relationships and hierarchy of events. It can be called fishbone or Ishikawa diagram. Causes in a cause & effect diagram are frequently arranged into four major categories. While these categories can be anything, we will often see:

  - manpower, methods, materials, and machinery (recommended for manufacturing)
  - Equipment, policies, procedures, and people (recommended for administration and service).

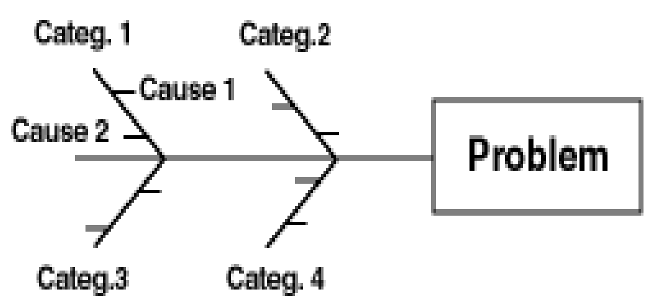


Figure 2.10 Cause and effect diagram

- Check Sheets
- **Histograms:** A histogram is used to graphically summarize and display the distribution of a process data set.

- **Pareto Charts:** It is a bar graph. A Pareto chart is used to graphically summarize and display the relative importance of the differences between groups of data. With this chart we can classify problems according to causes. The chart is based on the Pareto principle, which states that when several factors affect a situation, a few factors will account for most of the impact. About 80% of the problems are from 20% of the causes. Thus, a Pareto chart helps teams to focus their efforts where they can have the greatest potential impact (Brown,2004).

Figure 2.11 Pareto chart

- **Scatter Diagram:** A scatter diagram is a tool for analyzing relationships between two variables. One variable is plotted on the horizontal axis and the other is plotted on the vertical axis. The pattern of their intersection points can graphically show relationship patterns.

  Scatter diagrams will generally show one of six possible correlations between the variables:

  Strong Positive Correlation The value of Y clearly increases as the value of X increases.

  Strong Negative Correlation The value of Y clearly decreases as the value of X increases.

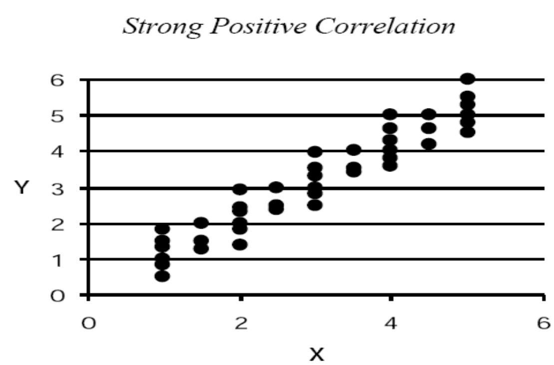
Weak Positive Correlation The value of Y increases slightly as the value of X increases.

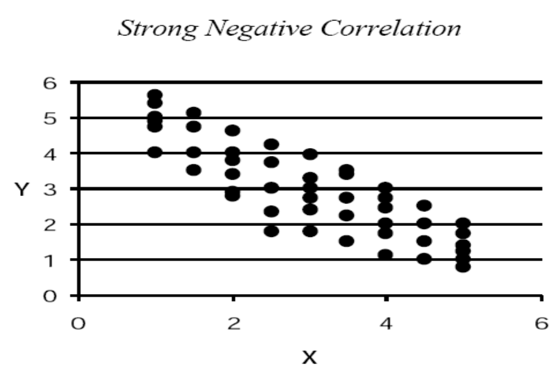
Weak Negative Correlation The value of Y decreases slightly as the value of X increases.

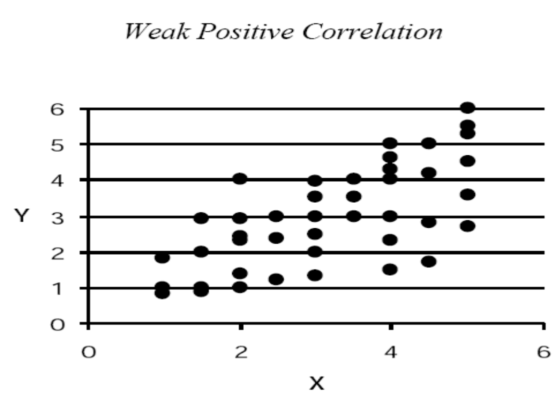
Complex Correlation The value of Y seems to be related to the value of X, but the relationship is not easily determined.

No Correlation There is no demonstrated connection between the two variables.

Examples :







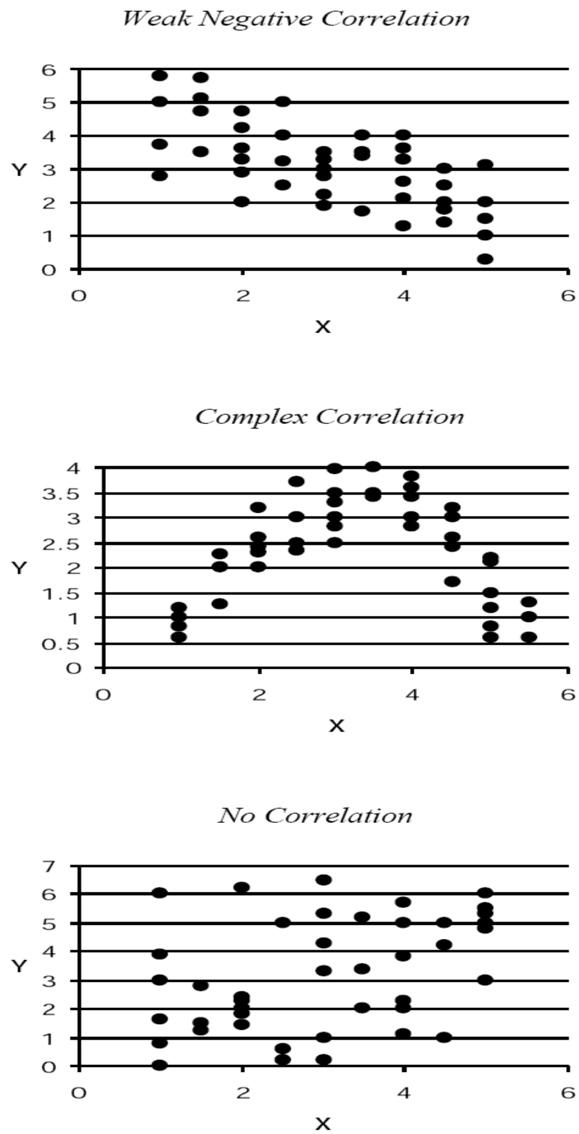


Figure 2.12 Scatter diagrams

- **Value Stream Maps:** The explanation of value stream maps and value stream mapping is in chapter 2.4.
- **Control Charts:** The control chart is a graph used to study how a process changes over time. Data are plotted in time order. A control chart always has a central line for the average, an upper line for the upper control limit and a lower line for the lower control limit. These lines are determined from historical data. By comparing current data to these lines, we can draw conclusions about whether the process

variation is consistent (in control) or is unpredictable (out of control, affected by special causes of variation).

- Benchmarking
- Brainstorming
- Process Mapping
- Spaghetti Diagrams
- Internal vs. External time and steps
- Root Cause Analysis (5 Whys)

Day 3: Developping the future state process

- **Brainstorming and Analysing and mapping flowcharts:** (typically the longest day of the event) The team should simulate new method, walk through mock-up or actual process with new method, create new work balance charts and make physical changes to the process.
- Kaizen team brainstorming to develop new process. The team post improvement ideas on map or by category.
  - Workflow,
  - Technology,
  - People and Organization,
  - Procedures.

- And develop detailed future state map
  - New workflow,
  - Value Add and Non-Value Add,
  - Cycle times,
  - Identify Kaizen "bursts" (immediate radical change).

Day 4: Implementing the new process

- At his step the team plan, communicate, implement and modify.

- They should spend the day working in the new process, tweak the process, identify bugs and make further improvements. They should rebuild the process and make sure it is functional.
- The team should think global and systems optimization.
- Speed of implementation is very important.
- Finally they analyse, for analysis below questions should be answered.
    - Will new skill sets be required, and how to achieve them?
    - Is the current organization structure sufficient?
    - Are there cultural issues?
    - Is there potential for "push back"?
    - Are there any implications for suppliers?
    - Are there any implications for customers?
    - Are there any implications for team members?
    - Do current technologies support the new process? Are they available and cost justifiable? Technology is an enabler, not a solution.
    - Does the reward system support the new process?

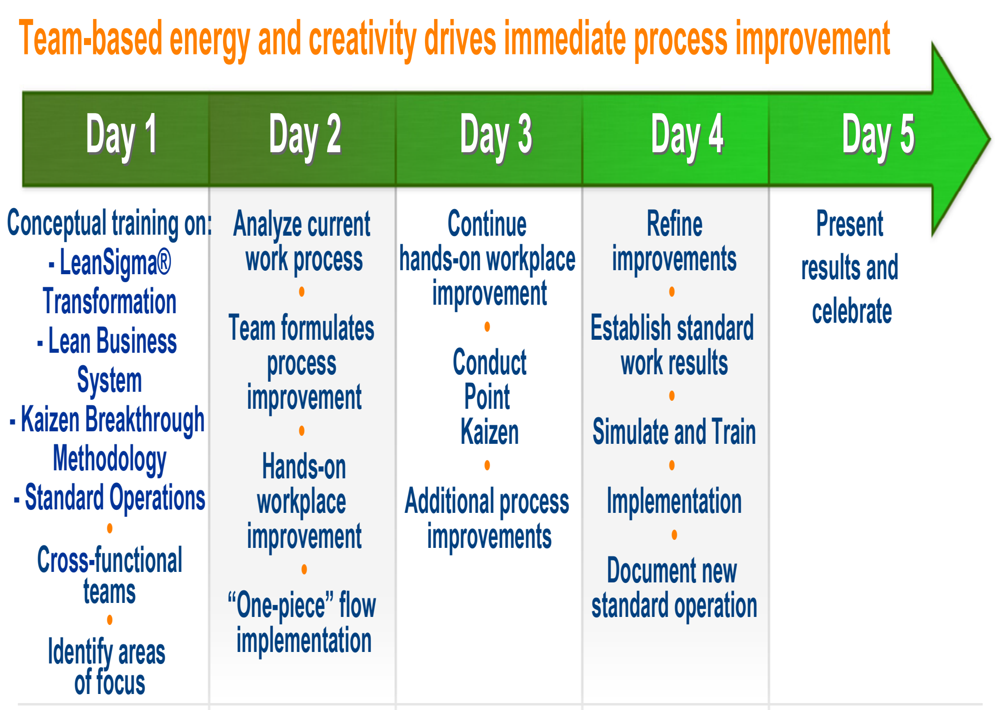
Day 5: Reporting and analysing; Sustaining and Celebrating

- Reporting begins with performance vs expectations report.
- The next step is measurements and documentation of the new current state. The other steps for reporting and analysing are:
- Identification of savings,
- Cost-benefit analysis,
- Creation of plans for fully implementing ideas,
- Creation of cross training plan,
- Identification of visual management triggers,
- Creating a sustaining plan,
- Presenting results to management team,
- Celebrating with a group lunch, certificates, group photo, etc.
- Development a concise, achievable milestone plan,

- Tracking activities in public,
- Celebrating small victories and publicly analysing failures,
- Communicating the plan to everyone, with all shifts.
    - Suppliers
    - Team members
    - Customers

Day N: Checking and Sustaining

- The team should meet regularly (for example weekly) to review status of open implementation items.
- The team should re-evaluate Future State regularly (for example quarterly) for additional improvement.
- Results are tracked on a public Kaizen Board (Miller, 2004).



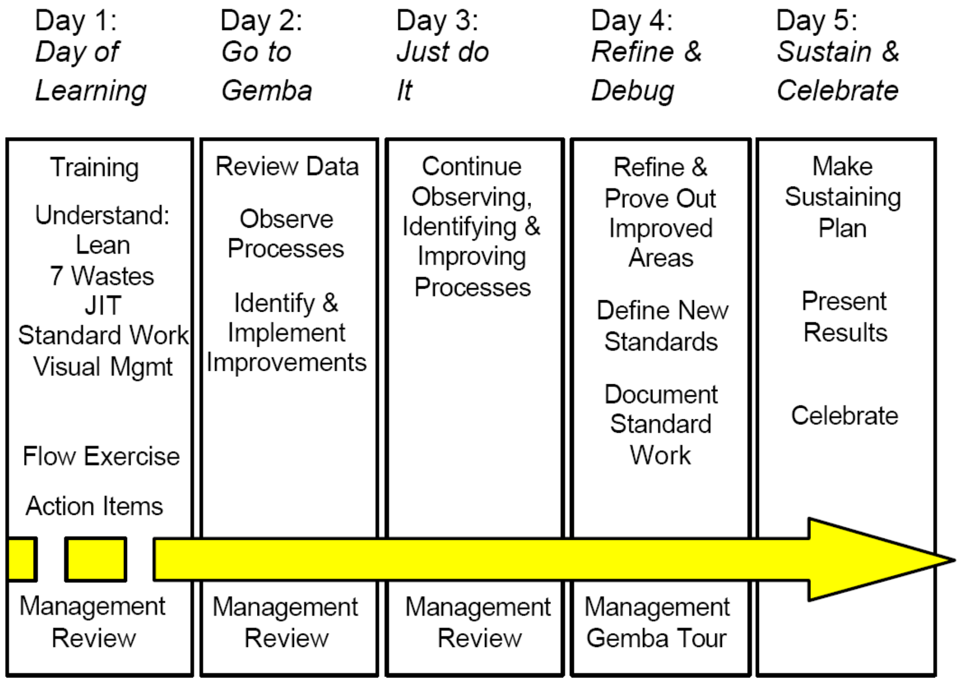


Figure 2.13 Examples of kaizen blitz agenda

2.4 The Definition of Value Stream and Value Stream Mapping

"Whenever there is a product for a customer, there is a value stream. The challenge lies in seeing it." (Rother & Shook, 2003).

Value Stream Mapping is one of the best tools to map a process and to identify its main criticalities and waste in the whole flow (Braglia, Carmignani&Zammori, 2006). A value stream is all the actions (both value added and non value added) currently required to bring a product or service from raw material through to the customer (Chitturi,Glew&Paulls,2007).

- Production flow from raw materials into the arms of the customer and
- The design flow from concept to launch and
- The information flow necessary to trigger and support these flows (Brunt,2000).

Value stream mapping is a pencil and paper tool that helps us to see and understand the flow of material and information as a product makes its way through the value stream. We should follow a product's production path from customer to supplier, and draw a visual representation of every process in the material and information flow. Then we ask a set of key questions and draw a future state map of how value should flow (Rother & Shook, 2003).

2.4.1 The Benefits of Value Stream Mapping

- It helps to visualize more than just the single process level, assembly, welding, etc in production. We can see the flow.
- It helps to see more than waste. Mapping helps us to see the sources of waste in the value stream.
- It provides a common language for talking about manufacturing processes. It gives the team a visual tool for representing their improvement ideas, so they are better able to communicate with people inside and outside the organization. It should be created with a team. Rarely does one person have all process knowledge.
- It makes decisions about the flow apparent, so we can discuss them. Otherwise, many details and decisions on our shop flor just happen by default.
- It ties together lean concepts and techniques, it forms the basis of Lean Production.
- It forms the basis of an implementation plan. By helping us to design how the whole door to door flow should operate. Value stream maps become a blueprint for lean implementation.
- It shows the linkage between the information flow and the material and product flow. No other tool does this.
- It is much more useful than quantitative tools and layout diagrams that produce a tally of no value added steps, lead time, distance traveled, the amount of inventory and so on. Value stream mapping is a qualitative tool by which we describe in detail how our facility should operate in order to create flow.

2.4.2 The Steps of Value Stream Mapping

Generally manufacturing processes are complex with flows merging together, because of this Value Stream Mapping can not be used straightforwardly. There are some methods to solve this complexity in literature. Temporized Bill of Material Method is one of them (Braglia, Carmignani&Zammori, 2006). Hines and Rich(1997) proposed a set of seven tools derived from industrial engineering to support the waste-removal process, namely, process activity mapping, supply-chain response matrix, production variety funnel, quality filter mapping, demand amplification mapping, decision point analysis and physical structure mapping . In Van Landeghem, McDonald & Rahn and Abdulmalek & Rajgopal's articals simulation is used to model and validate the current and future state map.

The basic idea is to identify critical production path. To do this selecting a product family and a material is an easy method (Tapping & Shuker, 2002). Before starting, the need to focus on one product family is important. A family is a group of products that pass through similar processing steps and over common equipment in downstream processes. Unless there is a small, one product plant, drawing all product flows on one map is too complicated. Value stream mapping means walking and drawing the processing steps (material and information) for one product family from door to door in the plant. The product family is most impacting customer service, with common flow, with high volume and cost, based on customer industry, or other product segmentation. By selecting the product family, how many different finished part numbers there are in the family, how much is wanted by the customer, and how often should be decided.

Second step is selecting the part to follow in the process. Following only one part is more helpful, we can learn much more by following only one part.

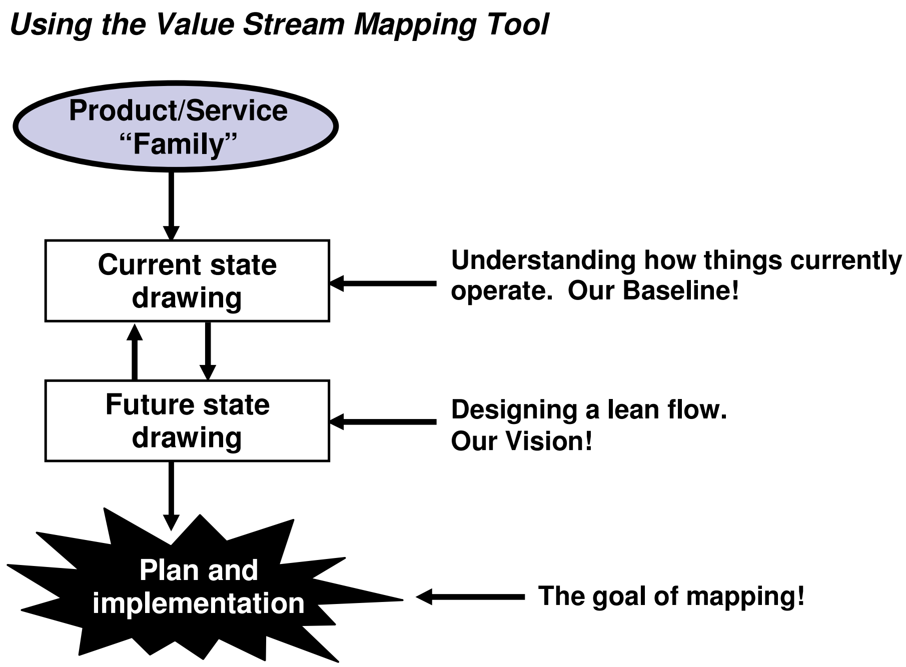
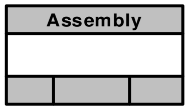
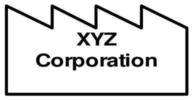
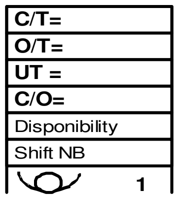
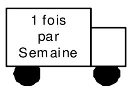
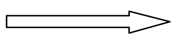
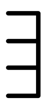


Figure 2.14 Using the value stream mapping tool

2.4.2.1 The Current State Map and Drawing the Current State Map

Creating a future state begins with an analysis of the current production situation. It generally takes a day and performed by a cross functional team responsible for implementing new ideas. The result is a picture of what we see when following the product.

We use a set of symbols or icons to represent processes and flows. The icons are in the figure 2.15 (Rother & Shook, 2003).

Icons	**Represents**	**Notes**
	Manufacturing Process	One Process box equals an area of flow. All Processes should be labeled. Also used for departments, such as Production Control.
	Outside Sources	Used to show customers suppliers, and outside manufacturing processes.
	Data Box	It used to record information concerning a manufacturing process, department, customer, etc.
	Inventory	Count and time should be noted
	Truck Shipment	Note frequency of shipments
	Movement of production material by Push	Material that is produced and moved forward before the next process needs it; usually based on a schedule.
	Movement of finished goods to the customer	
	Supermarket	A controlled inventory of parts that is used to schedule production at an upstream process.
	Withdrawal	Pull of materials, usually from a supermarket.

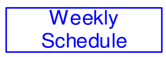
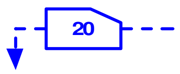
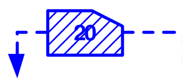
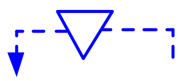
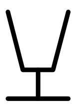
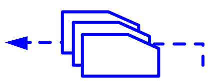
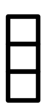
Icons	Represents	Notes
	Transfer of controlled quantities of material between processes in a "First in First out" sequence	Indicates a device to limit quantity and ensure FIFO flow of material between processes. Maximum quantity should be noted.
	Manuel Information Flow	For example production schedule or shipping schedule
	Electronic Information Flow	For example via electronic data interchange
	Information	Decribes an information flow.
	Production Kanban (dotted line indicates kanban path)	The one per container kanban. Card or device that tells a process how many of what can be produced and gives permission to do so.
	Withdrawal Kanban	Card or device that instructs the material handler to get and transfer parts from a supermarket to the consuming process.
	Signal Kanban	The one per batch kanban. Signals when a reorder point is reached and another batch needs to be produced. Used where supplying process must produced in batches because changeovers are required.
	Kanban Post	Place where kanban are collected and held for conveyance
	Kanban Arriving in Batches	
	Load Leveling	Tool to intercept batches of kanban and level the volume and mix of them over a period of time.
	" Go See " Production Scheduling	Adjusting schedules based on checking inventory levels.
	Kaizen Lightning Burst	Highlights improvement needs at specific processes that are critical to achieving the value stream vision. Can be used to plan kaizen workshops.
	Buffer or safety stock	
	Operator	Represents a person viewed from above.

Figure 2.15 Value stream map icons

2.4.2.1.1 Typical Steps to Complete a Current State Drawing.

- Documenting customer informations.
- Completing a quick walk through to identify the main processes (i.e., how many process boxes) – A process box indicates a process in which the material is flowing, we use the process box to indicate one area of material flow, ideally a continuous flow.
- How do we know whether a step and its attendant time create value? To answer this question we have to put ourselves in the position of the customer and ask if you would pay less for the product or be less satisfied if a given step and its necessary time were left out.
- Filling in data boxes, drawing inventory triangles, and counting inventory – We should carefully distinguish buffer stocks, safety stocks, and shipping stocks. Then determine standard inventory for current system design and capabilities.
- Documenting supplier informations.
- Establishing information flow: how does each process know what to make next? Information flow is drawn from right to left in the top of the map. A narrow line shows the information flow. The information flow is mapped from the customer to the production office and to all the shop floor operations.
- Identification where material is being pushed. Push means that a process produces something regardless of the actual needs of the downstream customer process and pushes it ahead. In this situation the supplying processes will tend to make parts their customer processes don't need at this moment, and those parts are pushed into storage.
- To qualify as pull, parts must not be produced or conveyed when there is no kanban, and the quantity of parts produced must be the same as specified on the kanban. We can use a supermarket pull system in value stream. A pull system supermarket is a clearly defined interface between process steps in a production process. The super markets help the company to reduce the inventory between two processes (McDonald, Van Aken&Rentes, 2002).
- Quantification production lead time vs. processing time. Process lead time is the time from release of a product into a process until it's' completion. With the data

from observation of current operations drawn or recorded on the map, the current condition of this value stream can be summarized. We draw a timeline under the process boxes and inventory triangles to compile the production lead time, which is the time it takes one part to make its way through the shop floor, beginning with arrival as raw material through to shipment to the customer.

- Lead time for each inventory triangle is calculated as follow: inventory quantity divided by the daily customer requirement.
- By adding the lead times through each process and through each inventory triangle in the material flow, we can arrive total production lead time. We can see an example of current state map in figure 2.16 (Rother & Shook, 2003).

Information For A Process Data Box (to be collected on the shop floor)

- **Cycle time:** The time that elapses between one parts coming off the process to the next part coming off. It shows how often a part or product actually is completed by a process.
- **Changeover time:** The time to switch from producing one product type to another at a machine.
- Process reliability (uptime)
- Scrap/Rework/Defect rate
- Number of product variations
- Number of operators (required to operate the process)
- Production batch sizes
- Working time (per shift at that process minus breaks)
- Pack size

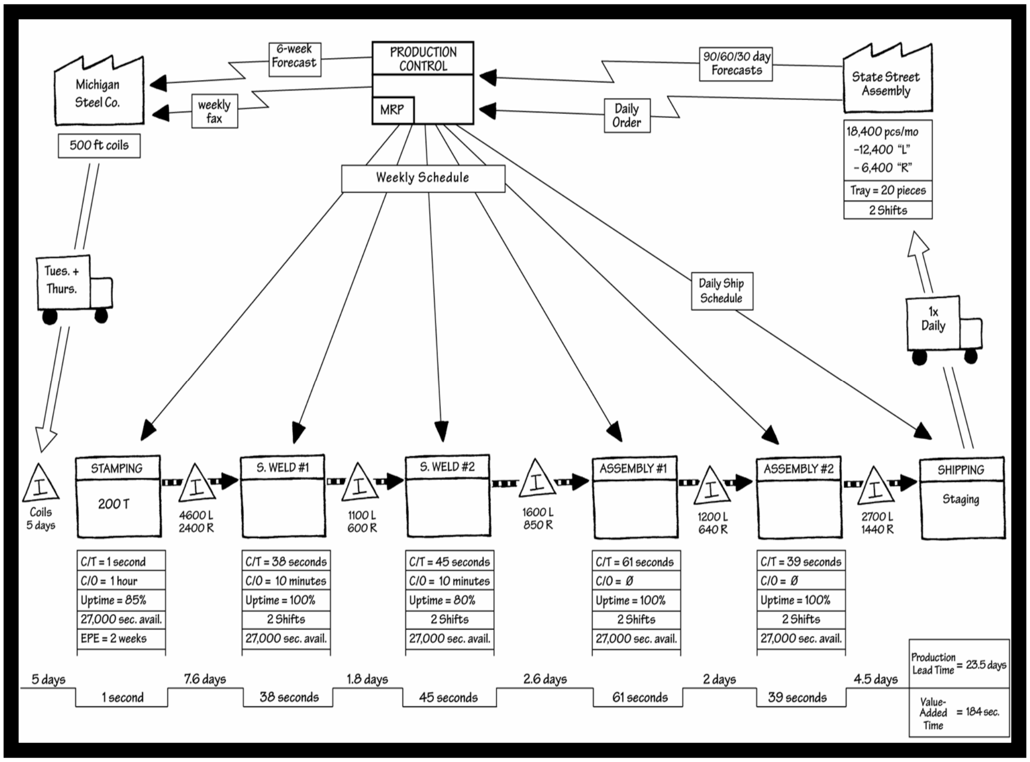


Figure 2.16 Current state map

Typical Results of the analysis of current state

- 80 – 90% of total steps are waste from standpoint of end customer.
- 99.9% of throughput time is wasted time.
- Demand becomes more and more erratic as it moves upstream, imposing major inventory, capacity, and management costs at every level.
- Quality becomes worse and worse as we move upstream, imposing major costs downstream.
- Most managers and many production associates expend the majority of their efforts on hand-offs, work-around, and logistical complexity.

2.4.2.2 The Future State Map and Drawing the Future State Map

To create a current state map is a muda unless we use the map to create and implement a future state map that eliminates wastes and increases value for the customer.

The purpose of value stream mapping is to highlight sources of waste and eliminate them by implementation of a future state value stream that can become a reality within a short period of time.

The Future state map is completed in a day with the same team of current state mapping.

It is focused on:

- Creating a flexible, reactive system that quickly adapts to changing customer needs. We try to link all processes from the final customer back to raw material in a smooth flow without detours that generates the shortest lead time, highest quality and lower cost. One process makes only what the next process needs and when it needs it.
- Eliminating waste and improving overall process efficiency – There are seven types of wastes at Lean, which we have mentioned in Chapter 2.2. They must be eliminated.
- Creating flow - Continuous flow must be established where possible. When we leave out wasted steps, create continuous flow, and introduce pull in every plant the product passes through we can achieve a reduction in steps and throughput time. Continuous flow refers to producing one piece at a time, with each item passed immediately from one process step to next without any wastes (Serrano, Ochoa&Castro, 2006).
- Producing on demand - What is the production rhythm (takt time) for each production facility needed to meet demand? This question should be answered.
- Takt time is how often we should produce one part based on the rate of sales to meet customer requirements and demand. It is calculated by dividing the customer demand rate per day into available working time per day (Chitturi, Glew&Paulls,2007).
- Finding necessary process improvements – Future state value stream is the place to note any equipment and procedural improvements that will be necessary, such as reducing changeover time etc. We use kaizen lightning burst icon to indicate these points in the process. The icon can be seen in figure 2.15.

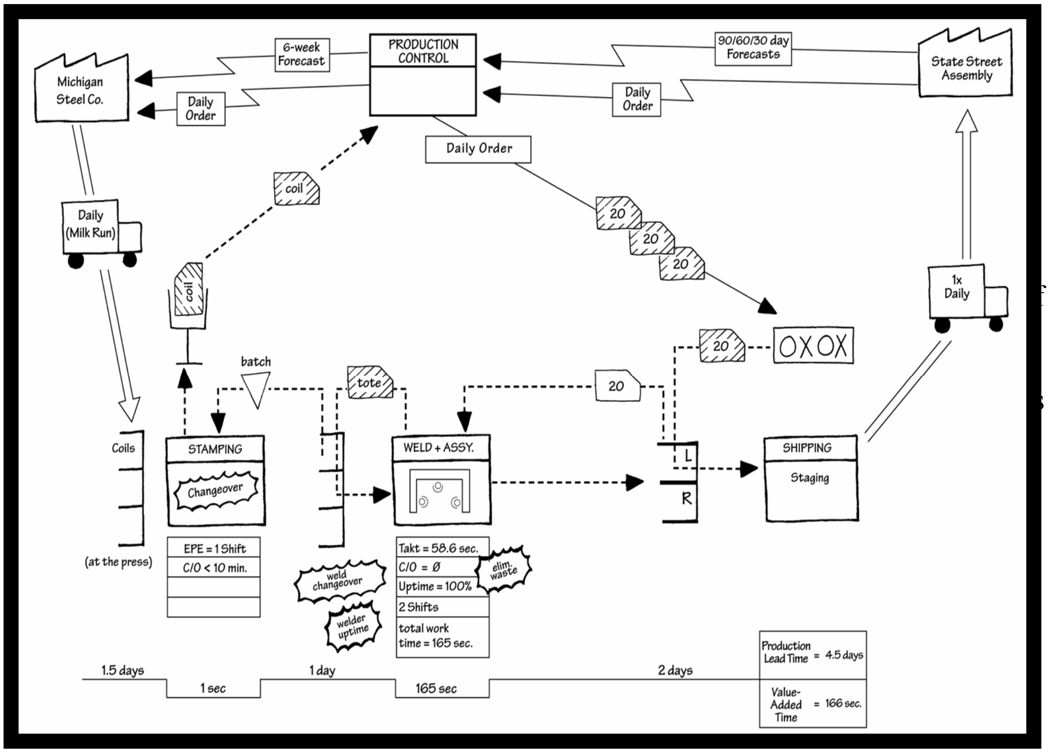


Figure 2.17 Future state map

2.4.2.3 The Extended Value Stream Mapping

The extended value stream mapping is the mapping the whole not only our company and also suppliers and customers. It is related with our customers, our suppliers and our supplier's suppliers. It requires permission and cooperation from each of our partners along the value stream. For EVSM, we move up the value stream across multiple plants, across companies and suppliers. We always start downstream and work our way upstream, across distribution center and customers. A team with members from each facility is needed.

There are some tools for analyzing the extended value stream such as:

- Quality Screen,
- Delivery Screen,
- Analysis of Supplier and Partner Delivery,

- Production Variety Tunnel,
- Demand Amplification,
- Travel Distance,
- Total Cost of Ownership Analysis.

The quality screen looks at the number of defects that occur along the value stream. It is quite normal that the number of defects is worse at every step up the value stream. The product flows through a series of quality screens in each facility. At supplier and partner on time delivery is critical to know what is the service level of suppliers and partners and to measure defective service as both too early and late. Because a supplier who consistently ships early is forcing us to carry excess inventory and a supplier who consistently ships late is causing us down time and wasted time expediting materials. Demand Amplification occurs in traditional manufacturing processes from the batching and control of inventory through the supply chain. A small amount of variation downstream causes larger amounts of variation upstream. Typical Symptoms of demand varition are excessive inventory levels poor customer service due to unavailable products or large backlogs, high costs for overtime and expedited shipping. Travel distance is a visual tool to understand the physical flow (Womack&Jones,2002).

2.4.2.3.1 Current State Extended Value Stream Mapping Tips.

- We should start with the customer.
- We should group and summarize the data of the facilities and the transport links.
- There are two new icons which were not used in VSM: the warehouse icon and the cross-dock icon.
- First map the physical flow completely
- Mapping the information flow is second step. (we use the production control icon where necessary)
- Information flows are usually much more difficult than physical flows. As in VSM, do not assume that any one person really know what is happening.

An example of current state extended VSM can be seen in figure 2.18.

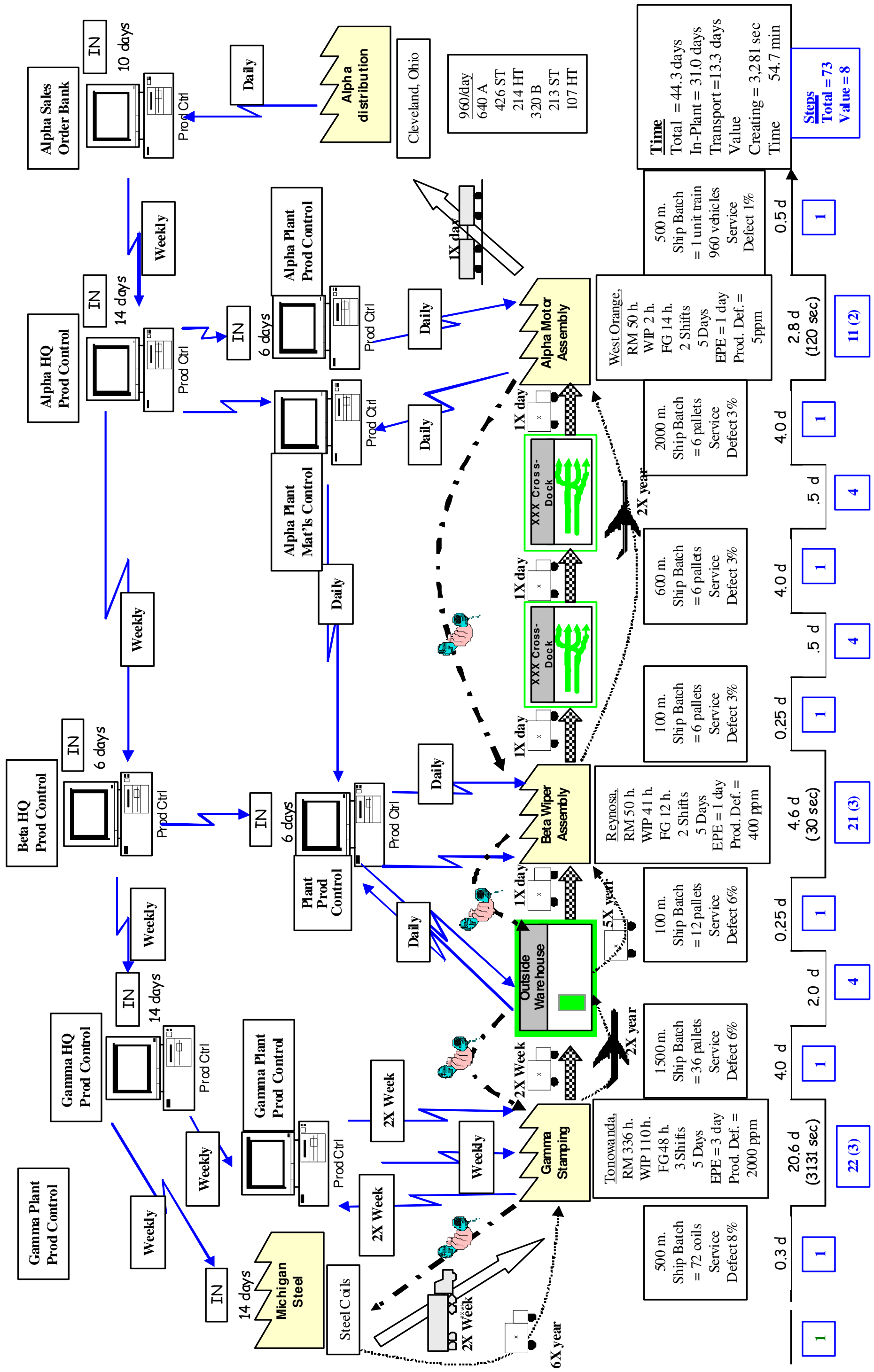


Figure 2.18 Current state extended value stream map

2.4.2.3.2 Future State Extended Value Stream Mapping Tips.

- After creating the current state and future state maps for each individual facility is accomplished, we will have a future state 1 map that looks visually very similar to the current state map, but there have been significant changes within the facilities.
- The next big step for all participants in the value stream is to draw the next future state. After completing the work within each facility, the completed Future State Map became the new Current State Map. It is time to attack the movement of materials and information between facilities with smooth and level pull, frequent shipments, single point scheduling, pull and WIP Control.

An example of future state extended VSM can be seen in figure 2.19.

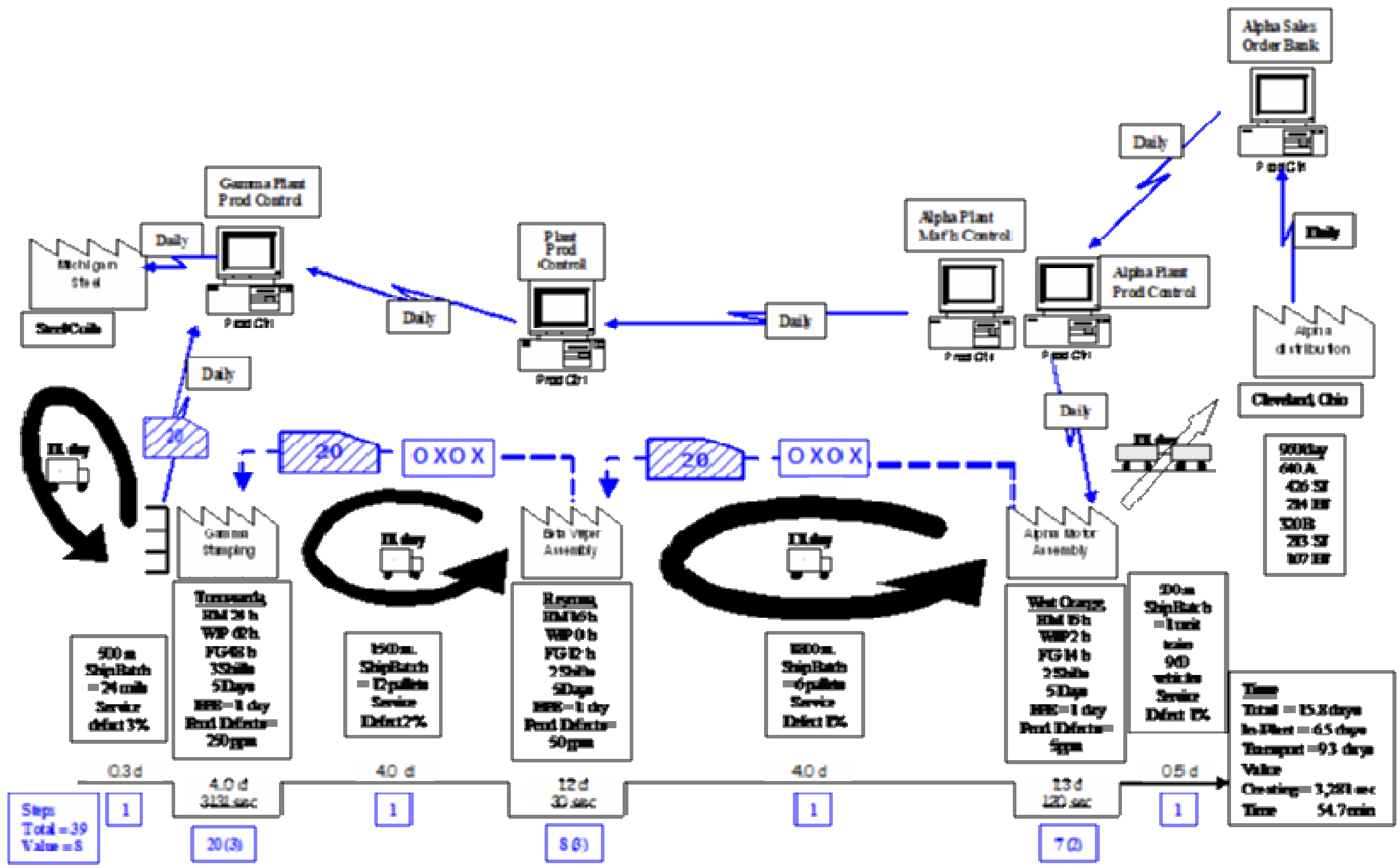


Figure 2.19 Future state extended value stream map

CHAPTER THREE
AN APPLICATION OF KAIZEN METHODOLOGY IN AN ELECTRONICS FIRM

In this study, we implemented Kaizen methodology in an electronics firm. In this chapter, we give details of the implementation. The company is a high variety high volume fabrication unit and under increasing pressure to increase productivity, reduce costs, inventories, and improve return on assets. The problem was how to produce more with what was already in hand. The company has decided to adopt Lean Principles in order to remain competetive in the market place. Because Lean production is a business model focused on cost reduction and eliminating waste and non value added activities in all areas of an organization through a commitment to continuous improvement and workforce development by all members of the organization.

To do this we began with a common lean principle known as "value stream mapping" (VSM) to document the flow and to see value added and non value added operations and activities. After creation of Current and Future State Value Streams there existed a need for Kaizen Blitz projects. Because Kaizen means change for the better. The purpose for holding a Kaizen project was basically to identify waste in a manufacturing process and to eliminate it, thereby improving production. In Lean manufacturing, this change for the better can result in gradual improvement of products, workplace efficiency, customer service, and reduction of waste. These are truly impressive results and these results weren't achieved by professionals with unlimited budgets. We chose problematic processes which are not efficient and had some production, quality, ergonomics and material providing problems in value stream. These inefficient processes affected the whole production line and interrupted the production and information flow. We applied Kaizen Blitz projects to these processes. We will analyse one of these Kaizen Blitz projects.

3.1 Company Presentation

The company acquired in 1836 and operates in electronics, energy and operation sector and in five end markets:

- Energy infrastructure: water, electrical energy, Oil and Gas;
- Industry, in particular process industry (automotive, consumer goods, packaging);
- Data centres & Networks. Booming market with the boom of digital everywhere,
- Buildings. From offices to retail, hotels or hospitals;
- Residential: homes and residential buildings

It is a global company present all over the world. 120000 people work at this company in more than 190 countries, 192 production sites, 150 service centers and some 13000 sales outlets.

The company history in Turkey began at 19th century. There are 1100 employees, 3 manufacturing facilities and 200 sales outlets. The company makes production for local and foreign markets. The production strategy is make – to – order strategy. However, make to stock strategy is also used for only one type of products.

3.2 The Problem Definition

The project was analysed in deming cycle and plan, do, check, act stages, we can see the flow of the Project in appendix. Kaizen efforts or any lean manufacturing technique are most effective when applied strategically within the context of building a lean value stream. Therefore, we started with the analysis of the factory value stream to decide the area of the Kaizen Blitz Project. We can see in appendix this was first step of the analysis.

3.2.1 Value Stream Maps of the Company

As mentioned before company production strategy is make to order strategy. The orders are designed according to the customer wants. The customers select the parts, the characteristics and the properties of the product. Because of this every order and every product is different from each other. Only some parts are common, but the percentage does not exceed 20%.

There are four different production lines at the company. At each line different products are produced. We have focused on only one product family and only one line. The first step of value stream mapping is to select a product family. A product family is defined as a group of products that pass through similar processing steps and over common equipment in the downstream processes. We analysed main types of products at the line and chose a product type, we made a product family chart to choose a product type. All products do not pass through all stations and all operations.

Table 3.1 The product family chart

Product Family Chart		Process Steps																					
		Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9	Station 10	Station 11	Station 12	Station 13	Station 14	Station 15	Station 16	Station 17	Station 18	Product Volume	%	PT	Product Family
Products	DMI-A		x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	1728	53%	590	1
	IM	x	x	x	x	x	x	x			x				x	x	x	x	x	701	22%	425	2
	QM	x	x	x	x	x	x	x			x				x	x	x	x	x	245	8%	415	2
	CMC		x	x	x	x	x	x	x	x	x		x		x	x	x	x	x	347	11%	500	1
	DM2		x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	23	1%	780	1
	GAM2			x	x	x	x	x					x		x	x	x	x	x	187	6%	420	3

We chose the product family according to the product volumes, processing times and the dowstream processes. As can be seen in Table 3.1, product family 1 passes through most of the processes and has high product volumes and processing times. Product volumes were decided according to the historical data and processing times were decided according to the time measurement analysis.

We used the stop watch technique and video analysis for the time measurement analysis. Video analysis is a helpful technique. Because anyone can catch everything while watching the videos and watch it many times, not only one time. With this method micro stoppages and short cycle time elements can be recorded, and it is useful for any types of tasks.

In the company the time standarts are analysed in different segments. Time standarts breakdown for the company is as useful time, design time, operation time of reference and time spent reference. Useful time is defined as the grand total of all added value times for an operation. Design Time is the grand total of all the predetermined times for an operation, it is the sum of value added times (useful time) and non value added times for an operation. Operation Time for Reference is the grand total of the Design Time and the estimated waste for a set of operations. Time Spent for Reference is the grand total of the Operation Time for Reference and the total of the support function DVC (direct variable cost) hours. It shows the support function DVC hours requirement.

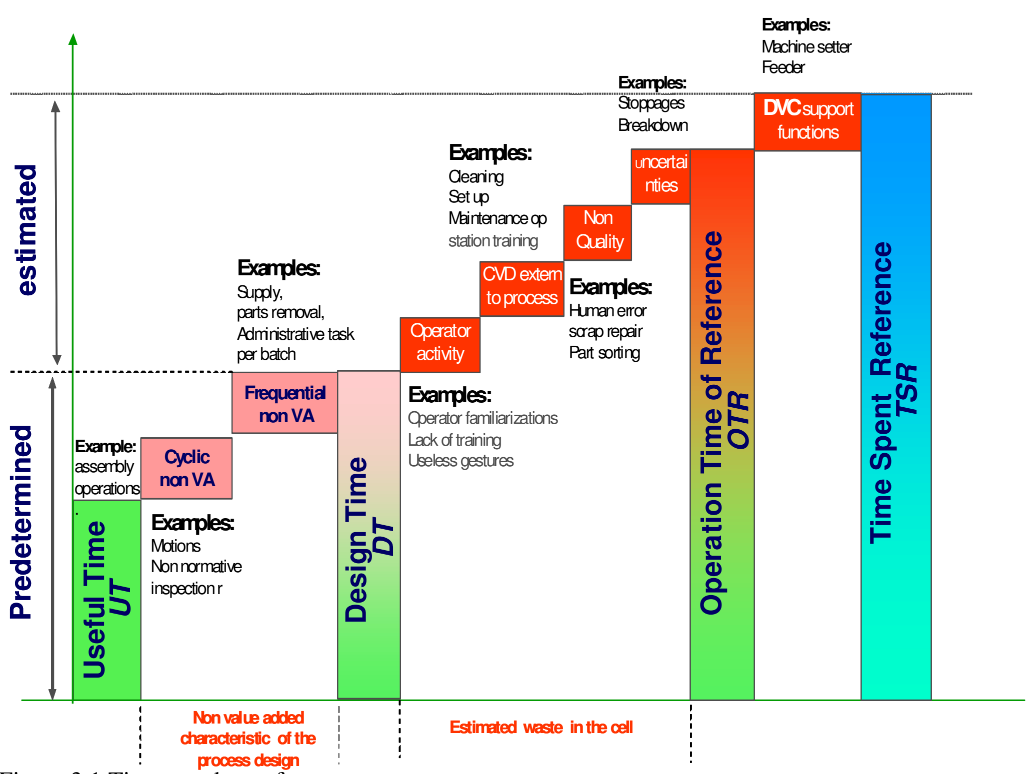


Figure 3.1 Time standarts of company

There are some coefficients to analyse the times. First of all the design coeffient KD is defined by the engineering department for each operation. It shows the efficiency of a process design (Added value of a process). KD = UT / DT

The second one is efficiency coefficient KER. It is defined for a cell or a process. It is extrapolated from historical data or according forecasted improvement. It is used to calculate the Operating Time for Reference from the Design Time in the ERP. OTR = DT / KER.

The third one is support function coefficient KSR. It is defined for a cell or a process. It is extrapolated from historical data or according to forecasted improvement. It enables to calculate the Time Spent for Reference from the Operation Time for Reference in the ERP. TSR = OTR / KSR.

And the last one is industrial efficiency coefficient. It shows the efficiency of the whole. IE = Useful Time / Time Spent. Theoretical breakdown of manufacturing labor times is as below.

Useful Time	Cyclic non VA	Frequential non VA	Operator Activity	DVC External to Process	Non Quality	Uncertainties

Useful Times for Pre-engineered products are:

- Value-added manual assembly operations
- Motions inside of the ergonomic zone (parts or tools)
- Normative controls or controls required by customer
- Packaging before shipment

Useful Times for Engineered-To-Order products are :

- Same definitions than pre-engineered product
- + reading drawings or documentation useful for the product assembly
- + fill in administrative document to be sent to customer
- + picking and packaging parcel to be sent to customer

Useful Time	Cyclic non VA	Frequential non VA	Operator Activity	DVC External to Process	Non Quality	Uncertainties

Cyclic elements are sequential actions proportional to the volume, for example :

- Motions outside of the ergonomic zone
- Moving outside of the working zone (procurement, taking parts from the line etc.)
- Quality non-normative control, visual control
- Non value-added cyclic element or operation
- Cyclic administrative task conducted by direct workers
- Operating waiting time
- Physiological rest

Useful Time	Cyclic non VA	Frequential non VA	Operator Activity	DVC External to Process	Non Quality	Uncertainties

Frequential elements are sequential actions proportional to "n" cycles :

- Procurement or removal of products or parts
- Sampling quality control
- Batch label printing
- Non value-added sequential element or operation
- Non cyclic administrative task conducted by direct workers
- Change over

Useful Time	Cyclic non VA	Frequential non VA	Operator Activity	DVC External to Process	Non Quality	Uncertainties

Operator Activity is the operator performance, difference between target and actual time due to :

- Learning curve
- Lack of training, of operating method, of skill
- Non value-added motions

Useful Time	Cyclic non VA	Frequential non VA	Operator Activity	DVC External to Process	Non Quality	Uncertainties

DVC External to Process are:

- Work Station cleaning (5S)
- Set up and flexibility
- Maintenance done by operator
- Releasing orders and manufacturing control
- Work station training and process management meeting
- Running physical inventory (cell in operation)

Useful Time	Cyclic non VA	Frequential non VA	Operator Activity	DVC External to Process	Non Quality	Uncertainties

Non Quality are:

- Defective product repairs
- Time spent in manufacturing rejected products
- Product rework and sorting out parts

Useful Time	Cyclic non VA	Frequential non VA	Operator Activity	DVC External to Process	Non Quality	Uncertainties

Uncertainties are :

- Involuntary stoppages and short waiting time(for example: due to equipment malfunction)
- Operation done out of process (human, equipment, parts)

Useful Time	Cyclic non VA	Frequential non VA	Operator Activity	DVC External to Process	Non Quality	Uncertainties	DVC support functions

DVC support functions times are the whole DVC tasks regarding the production flow, conducted by non direct workers, totally or partially assigned to a production sector. Products design times classified as DVC are not taken into account in support functions hours to measure the manufacturing performance IE. Examples of DVC support functions tasks are:

- Machine setting, changeover, equipment programming, on task operator training
- In time production control: launching & releasing production, time recording, planning.
- Incoming inspection & repackaging
- Line replenishment, product outbound
- In process and finish goods inspection

For value stream mapping and Kaizen we have analysed only the design times and useful times of the processes. But the company makes these analysis every month and report them. KER is the efficieny and the target of the production department. KD is the efficieny of the method department, because it is related with the design of the line and to improve this value, the design and equipments of the line should be changed. The KSR is the support functions efficiency like planning department. And the departments are responsible to keep these coefficients high. One example of the company's report and company's design time, coefficient KD calculation sheets are given below.

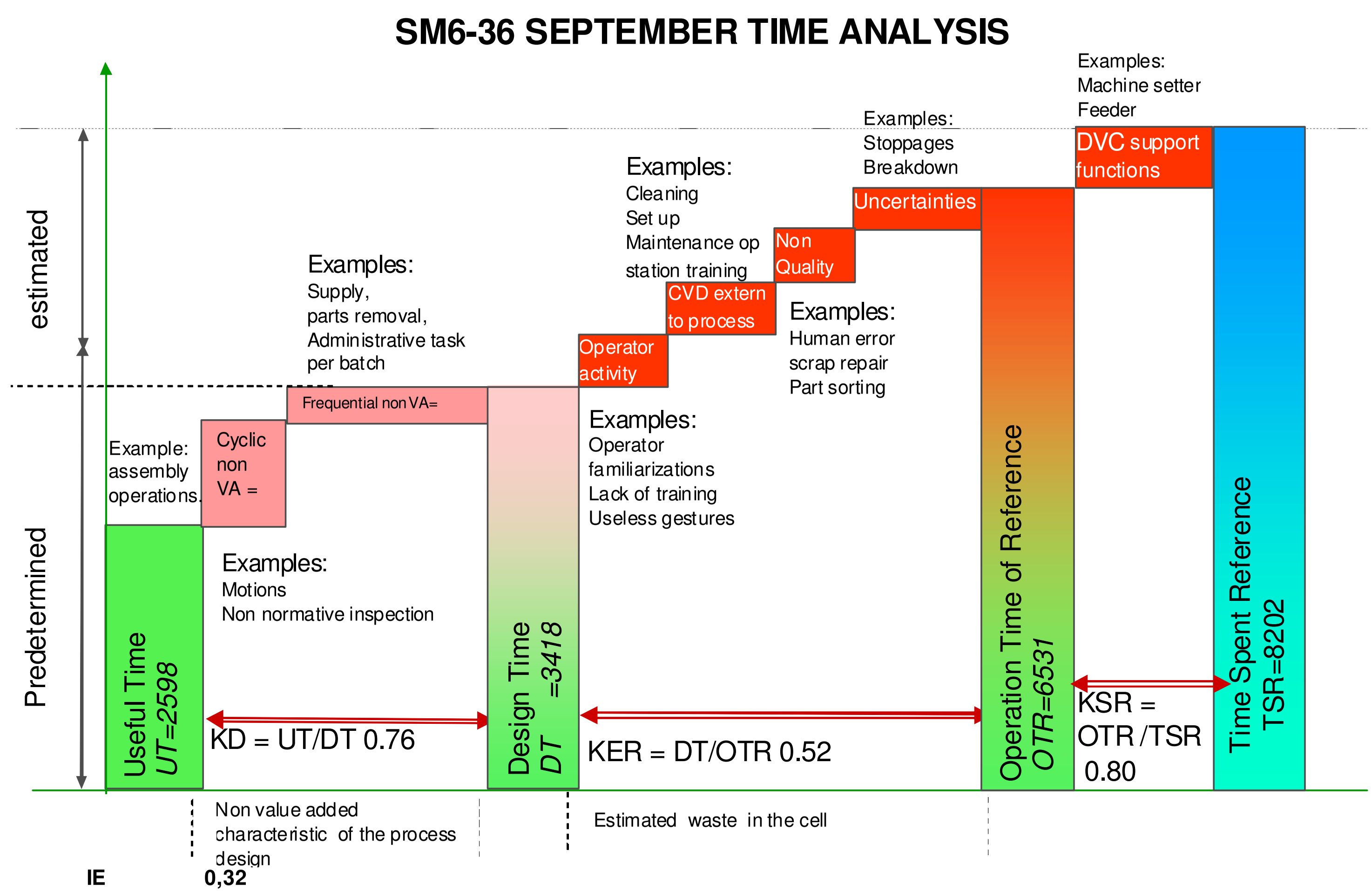


Figure 3.2 One example of the company's reports

Table 3.2 Company’s design time and coefficient KD calculation sheet

			PRODUCT TYPES									
			DM1A				DM1A	CMC	IM	IM Level C	QM	QM Level C
			1250 A		630 A							
			LPCT	CT,VT	LPCT	CT, VT	LevelC					
STATIONS	1. Station	Green (UT)	0	0	0	0	0	0	4030	2160	4030	2160
		Red	0	0	0	0	0	0	1333	1440	1333	1440
		Design Time (DT)	0	0	0	0	0	0	5363	3600	5363	3600
		KD	0,00	0,00	0,00	0,00	0,00	0,00	0,75	0,60	0,75	0,60
	2. Station	Green (UT)	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190
		Red	550	550	550	550	550	550	550	550	550	550
		Design Time (DT)	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740
		KD	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68
	3. Station	Green (UT)	2590	2590	2590	2590	2590	2590	2590	2590	2590	2590
		Red	635	635	635	635	635	635	635	635	635	635
		Design Time (DT)	3225	3225	3225	3225	3225	3225	3225	3225	3225	3225
		KD	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80	0,80
	4. Station	Green (UT)	861	861	861	861	861	521	548	548	548	548
		Red	579	579	579	579	579	259	351	351	351	351
		Design Time (DT)	1440	1440	1440	1440	1440	780	899	899	899	899
		KD	0,60	0,60	0,60	0,60	0,60	0,67	0,61	0,61	0,61	0,61
	5. Station	Green (UT)	1048	1048	1048	1048	1135	239	719	1135	974	1135
		Red	310	310	310	310	365	123	309	365	260	365
		Design Time (DT)	1358	1358	1358	1358	1500	362	1028	1500	1234	1500
		KD	0,77	0,77	0,77	0,77	0,76	0,66	0,70	0,76	0,79	0,76
	6. Station	Green (UT)	1267	991	1145	991	0	116	134	0	987	0
		Red	743	479	625	479	0	34	46	0	483	0
		Design Time (DT)	2010	1470	1770	1470	0	150	180	0	1470	0
		KD	0,63	0,67	0,65	0,67	0,00	0,77	0,74	0,00	0,67	0,00
	7. Station	Green (UT)	1050	1050	1050	1050	0	1050	844	0	844	0
		Red	510	510	510	510	0	510	356	0	356	0
		Design Time (DT)	1560	1560	1560	1560	0	1560	1200	0	1200	0
		KD	0,67	0,67	0,67	0,67	0,00	0,67	0,70	0,00	0,70	0,00
	8. Station	Green (UT)	1220	1520	1220	1520	0	1520	0	0	0	0
		Red	580	880	580	880	0	880	0	0	0	0
		Design Time (DT)	1800	2400	1800	2400	0	2400	0	0	0	0
		KD	0,68	0,63	0,68	0,63	0,00	0,63	0,00	0,00	0,00	0,00
	9. Station	Green (UT)	1169	2007	1169	2007	0	3488	875	906	564	0
		Red	338	510	338	510	0	1173	266	216	176	0
		Design Time (DT)	1507	2517	1507	2517	0	4661	1141	1122	740	0
		KD	0,78	0,80	0,78	0,80	0,00	0,75	0,77	0,81	0,76	0,00
	10. Station	Green (UT)	1193	1310	1515	1310	379	1240	1677	180	577	180
		Red	255	490	265	490	204	315	543	120	117	120
		Design Time (DT)	1448	1800	1780	1800	583	1555	2220	300	694	300
		KD	0,82	0,73	0,85	0,73	0,65	0,80	0,76	0,60	0,83	0,60
	11. Station	Green (UT)	1707	1724	1054	1054	0	1204	0	0	0	0
		Red	298	281	286	286	0	216	0	0	0	0
		Design Time (DT)	2005	2005	1340	1340	0	1420	0	0	0	0
		KD	0,85	0,86	0,79	0,79	0,00	0,85	0,00	0,00	0,00	0,00
	12. Station	Green (UT)	1079	1079	1079	1079	0	0	0	0	0	0
		Red	281	281	281	281	0	0	0	0	0	0
		Design Time (DT)	1360	1360	1360	1360	0	0	0	0	0	0
		KD	0,79	0,79	0,79	0,79	0,00	0,00	0,00	0,00	0,00	0,00
	13. Station	Green (UT)	195	195	195	195	195	195	195	195	195	195
		Red	105	105	105	105	105	105	105	105	105	105
		Design Time (DT)	300	300	300	300	300	300	300	300	300	300
		KD	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65
	14. Station	Green (UT)	1084	1377	1194	642	0	664	498	470	498	470
		Red	293	0	183	735	0	338	342	150	342	150
		Design Time (DT)	1377	1377	1377	1377	0	1002	840	620	840	620
		KD	0,79	1,00	0,87	0,47	0,00	0,66	0,59	0,76	0,59	0,76
	15. Station	Green (UT)	2295	2295	2295	2295	720	1485	165	858	226	858
		Red	405	405	405	405	180	985	361	178	245	178
		Design Time (DT)	2700	2700	2700	2700	900	2470	526	1036	471	1036
		KD	0,85	0,85	0,85	0,85	0,80	0,60	0,31	0,83	0,48	0,83
	16. Station	Green (UT)	657	657	657	657	657	708	608	432	524	524
		Red	183	183	183	183	183	192	160	228	228	228
		Design Time (DT)	840	840	840	840	840	900	768	660	752	752
		KD	0,78	0,78	0,78	0,78	0,78	0,79	0,79	0,65	0,70	0,70
	17. Station	Green (UT)	2320	2320	2320	2320	0	1450	706	0	765	0
		Red	735	735	735	735	0	650	928	0	435	0
		Design Time (DT)	3055	3055	3055	3055	0	2100	1634	0	1200	0
		KD	0,76	0,76	0,76	0,76	0,00	0,69	0,43	0	0,64	0,00
	18. Station	Green (UT)	996	996	996	996	996	996	996	996	996	996
		Red	530	530	530	530	530	530	530	530	530	530
		Design Time (DT)	1526	1526	1526	1526	1526	1526	1526	1526	1526	1526
		KD	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65

STATIONS		PRODUCT TYPES									
		GAM	GAM2	GAM 2 PLUS	SM	GBCB	DM1C	DM2 Level C	DM2	CM	Total
1. Station	Green (UT)	0	0	0	2160	0	0	0	0	2160	4030
	Red	0	0	0	1440	0	0	0	0	1440	1333
	Design Time (DT)	0	0	0	3600	0	0	0	0	3600	5363
	KD	0,00	0,00	0,00	0,60	0,00	0,00	0,00	0,00	0,60	0,75
2. Station	Green (UT)	1190	1190	1190	1190	1190	1190	1190	1190	1190	4760
	Red	550	550	550	550	550	550	550	550	550	2200
	Design Time (DT)	1740	1740	1740	1740	1740	1740	1740	1740	1740	6960
	KD	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68	0,68
3. Station	Green (UT)	2590	2590	2590	2590	2590	7120	2590	7120	2590	10360
	Red	635	635	635	635	635	1280	635	1280	635	2540
	Design Time (DT)	3225	3225	3225	3225	3225	8400	3225	8400	3225	12900
	KD	0,80	0,80	0,80	0,80	0,80	0,85	0,80	0,85	0,80	0,80
4. Station	Green (UT)	1000	1000	1015	1662	861	861	1200	1312	548	3746
	Red	500	500	520	400	579	579	600	788	351	1530
	Design Time (DT)	1500	1500	1535	2062	1440	1440	1800	2100	899	5276
	KD	0,67	0,67	0,66	0,81	0,60	0,60	0,67	0,62	0,61	0,71
5. Station	Green (UT)	1048	1048	1048	663	1048	1048	592	1450	663	7379
	Red	310	310	310	282	310	310	195	650	282	2409
	Design Time (DT)	1358	1358	1358	945	1358	1358	787	2100	945	9788
	KD	0,77	0,77	0,77	0,70	0,77	0,77	0,75	0,69	0,70	0,75
6. Station	Green (UT)	844	133	133	133	0	0	195	195	133	5959
	Red	356	47	47	47	0	0	105	105	47	3041
	Design Time (DT)	1200	180	180	180	0	0	300	300	180	9000
	KD	0,70	0,74	0,74	0,74	0,00	0,00	0,65	0,65	0,74	0,66
7. Station	Green (UT)	1050	180	180	844	475	0	0	0	844	7782
	Red	510	120	120	356	125	0	0	0	356	3618
	Design Time (DT)	1560	300	300	1200	600	0	0	0	1200	11400
	KD	0,67	0,60	0,60	0,70	0,79	0,00	0,00	0,00	0,70	0,68
8. Station	Green (UT)	0	0	0	0	0	2780	0	2780	0	7000
	Red	0	0	0	0	0	1300	0	1300	0	3800
	Design Time (DT)	0	0	0	0	0	4080	0	4080	0	10800
	KD	0,00	0,00	0,00	0,00	0,00	0,68	0,00	0,68	0,00	0,65
9. Station	Green (UT)	0	0	883	1199	1570	0	532	2404	2368	19134
	Red	0	0	285	225	350	0	189	711	668	5445
	Design Time (DT)	0	0	1168	1424	1920	0	721	3115	3036	24579
	KD	0,00	0,00	0,76	0,84	0,82	0,00	0,74	0,77	0,78	0,78
10. Station	Green (UT)	180	180	180	180	521	1650	496	1110	759	6945
	Red	120	120	120	120	216	1050	314	510	273	1694
	Design Time (DT)	300	300	300	300	737	2700	810	1620	1032	8639
	KD	0,60	0,60	0,60	0,60	0,71	0,61	0,61	0,69	0,74	0,80
11. Station	Green (UT)	0	0	0	0	441	1890	0	1602	191	4597
	Red	0	0	0	0	296	1110	0	660	56	1152
	Design Time (DT)	0	0	0	0	737	3000	0	2262	247	5749
	KD	0,00	0,00	0,00	0,00	0,60	0,63	0,00	0,71	0,77	0,80
12. Station	Green (UT)	0	0	0	0	0	0	0	1079	0	2158
	Red	0	0	0	0	0	0	0	281	0	562
	Design Time (DT)	0	0	0	0	0	0	0	1360	0	2720
	KD	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,79	0,00	0,79
13. Station	Green (UT)	195	195	195	195	1459	195	195	195	195	1459
	Red	105	105	105	105	296	105	105	105	105	296
	Design Time (DT)	300	300	300	300	1755	300	300	300	300	1755
	KD	0,65	0,65	0,65	0,65	0,83	0,65	0,65	0,65	0,65	0,83
14. Station	Green (UT)	651	651	651	2442	651	642	642	642	617,5	7068,5
	Red	392	392	392	616	392	403	403	403	275,5	2809,5
	Design Time (DT)	1043	1043	1043	3058	1043	1045	1045	1045	893	9878
	KD	0,62	0,62	0,62	0,80	0,62	0,61	0,61	0,61	0,69	0,72
15. Station	Green (UT)	463	463	463	226	463	4915	463	4746	226	6791
	Red	137	137	137	245	137	1655	137	1854	245	3246
	Design Time (DT)	600	600	600	471	600	6570	600	6600	471	10037
	KD	0,77	0,77	0,77	0,48	0,77	0,75	0,77	0,72	0,48	0,68
16. Station	Green (UT)	654	654	654	524	654	657	780	657	524	4404
	Red	156	156	156	228	156	183	450	183	228	1588
	Design Time (DT)	810	810	810	752	810	840	1230	840	752	5992
	KD	0,81	0,81	0,81	0,70	0,81	0,78	0,63	0,78	0,70	0,73
17. Station	Green (UT)	650	650	650	765	650	3901	0	2320	765	9247
	Red	250	250	250	435	250	664	0	735	435	3062
	Design Time (DT)	900	900	900	1200	900	4565	0	3055	1200	12309
	KD	0,72	0,72	0,72	0,64	0,72	0,85	0,00	0,76	0,64	0,75
18. Station	Green (UT)	996	996	996	996	996	996	996	996	996	3984
	Red	530	530	530	530	530	530	530	530	530	2120
	Design Time (DT)	1526	1526	1526	1526	1526	1526	1526	1526	1526	6104
	KD	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65

3.2.1.1 Current State Value Stream Map of the Company

After selecting the product family we started to map the value stream. We talked with the production planning department, the production department, the customers, the selected supplier, the supervisor and the operators to collect necassary data. Then, we started current state value stream mapping for the chosen product family. We used Microsoft Visio tool for mapping. This tool has all value stream mapping icons. Mapping started with the customer informations and from the point customer places the required customised order. We had represent the customer's assembly plant with a factory icon and place it in the upper right place of the map.

For the product family the products were sold to local market and import. For local market the shipments were generally weekly. For import the shipment frequency was 3 times in a week. After the packaging station the products were taken to a shipping area (triangle stocking icon) and delivered by trucks for local market and by vessels for import. A truck and vessel icon and a broad narrow indicated movement of finished goods to the customer. A customer order went through main processes and data was collected in upstream direction from the packing operation to the first operation in the processes. The manufacturing and assembly processes were drawn from left to right along the bottom of the map. To indicate a process we used a process box. The processes on the shop floor were the stations which we had analysed at product family analysis. There were 18 main processes. But we did not use one box for every single processing step, because we used the box to indicate one area of material flow. If there was an assembly process with several connected workstations and if there was some WIP inventory between stations, we drew as one process box. As a result we had 5 main processes and 3 main subassemly processes. We showed subassembly processes above of the main processes and the link between them.

The next step was drawing data box under each process box and writing informations of the process. The informations for each processes were cycle time, processing time, change over time, machine uptime, number of shifts, number of batches and number of workers. The line was a manuel assembly line and we did not have any machine at this line. Because of this the machine uptime was 100% and the changeover time was zero for each station. In the company there was only one shift for all production lines. Cycle time is the time of one part coming off the process to the next part coming off in minutes. The bottleneck station in the process is important to decide the cycle time of the process. Because the cycle time can not be lower than the bottleneck station time. The processing time is the total time of the operations in the process. We have analysed the cycle times of the processes with the video analysis. We wrote these cycle times in data boxes as can be seen below in the current state value stream map in Figure 3.3.

After writing these informations we showed inventories between stations. To show inventory a warning triangle icon was used. This inventory is the inventory that we have seen at that moment in the line, and this data was collected whilst walking the shop floor. We counted the waiting parts before processes and wrote these as inventory.

At the other end of the map, we showed one of the company supplier with another factory icon. We chose only one main raw material and we did not map all purchased parts. While choosing the raw material we have evaluated costs and values of all materials and chose the most expensive one. For this chosen part the supplier is another plant of the company and it was next to our plant. The plant made 6 to 8 deliveries in a day with the batch quantity 4. The number of deliveries changed according to the need of the line, it is equal to the order quantity divided batch quantity times a day and kanban methodology was used between plants for this material.

The major step included the drawing of push, pull and first-in-first-out (FIFO) locations. If a process is producing to a schedule independent of the downstream process this indicates that push is being practised. Other scenarios may include some combination of pull and FIFO. Between some processes in the line FIFO was used, for the other ones push flow was used. For push the mapping icon is a striped arrow.

Information flow was drawn from right to left in the top half of the map space. This information flow shows how does the plant and the supplier plant know how much to make and when. To draw the information flow a narrow line and a lightening narrow line were used. We used lightening narrow line when the information flows electronically. The flow started with the customers and went back from there to the plant planning department and from there to supplier plant. We showed the production planning department with a process box. SAP was used for material requirements planning, for production planning and for all other functions in the plant. The production planning department collected the informations from customer and from production, processed these informations and sent instructions and informations to each manufacturing process about what should be produced and when, and also sent a shipping schedule to the supplier plant. The production planning got forecasts directly from customers and from sales channels. The forecasts are for the coming 6 months and they measured the forecast accuracy according to the realised orders. They made a rolling forecast from the accuracy and the forecast data. The daily customer demand could not calculated, because the frequency and the quantity of orders changed for every new order. For this reason we have calculated the takt time of customer orders for all product families according to the historical data. Takt time is how often the line should produce one part based on the rate of sales to meet customer requirements and demand. It was calculated by dividing the customer demand rate per day into available working time per day.

From the table 3.1 we calculated the takt time as below:

Annual quantity for product family 1 (sum of products quantities) = 2098

% of total range = Annual quantity / Total quantity = 2098 / 3231 = 65%

Annual quantity for product family 2 (sum of products quantities) = 946

% of total range = Annual quantity / Total quantity = 946 / 3231 = 29%

Annual quantity for product family 3 (sum of products quantities) = 187

% of total range = Annual quantity / Total quantity = 187 / 3231 = 6%

Quantity per day for product family 1 = Annual quantity / working days = 2098/250 = 8.4

Quantity per day for product family 2 = Annual quantity / working days = 946/250 = 3.8

Quantity per day for product family 3 = Annual quantity / working days = 187/250 = 0.7

Quantity per day is 13 (8.4+3.8+0.7=12.9) .

The working time per day is 510 minutes. (one shift 8 hour minus 30 minutes break)

The the takt time is 510 minutes / 13 pieces in a day = 39 minutes

This means the line had to produce a part every 39 minutes to accomplish the customer needs and wants.

The production planning department sent 3 months forecast and weekly orders to the supplier plant. According to the weekly order quantities the supplier plant delivered the materials daily. The production planning department sent a production plan to the production weekly. And the production responsible gave this plan to two main stations to trigger the production. Now we could summarize the current condition of the value stream. We drew a timeline under the process boxes and inventory triangles to find the processing times and the production lead time, which is the time it takes one part to make its way through the shop floor, beginning with arrival as raw material through to shipment to the customer. Lead times for inventory triangles were calculated by dividing the inventory quantity to the daily customer requirement. This time is the production waiting time. For example 16 pieces inventory divided 13 pieces daily customer requirement (for the current state takt time is 39 minutes, it makes 510/39=13 pieces daily requirement.) and it made 1.23 day lead time. Total production lead time is the sum of inventory triangle times. The processing time was calculated by adding the processing time for each process in the value stream. For the line under consideration total production lead time was 16.68 days and the processing time was 9 hours and 47 minutes. All these informations can be seen in the current state map of the company in Figure 3.3.

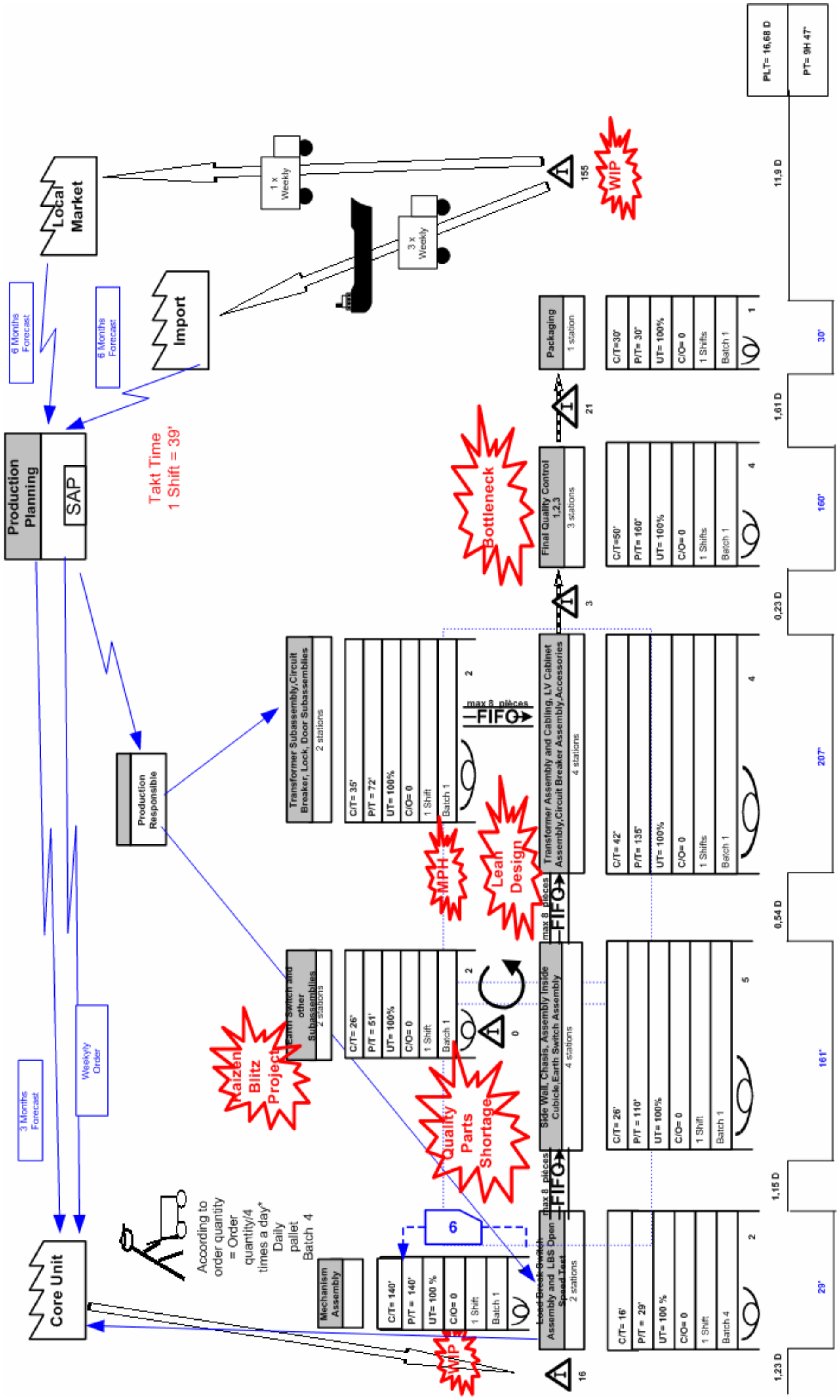


Figure 3.3 Current state value stream map of the company

3.2.1.2 Future State Value Stream Map of the Company

After we finished Current State Mapping we started to map the future state value stream of the chosen product family and line. Future state map showed where should the line go. For future state the root causes of wastes in the value stream should be eliminated. To eliminate the root causes of wastes and to make the line leaner we had to focus on the seven wastes of lean manufacturing.

Before starting we highlighted the improvement needs for speficific and problematic processes on the current state map and wrote the opportunities and projects to solve the problems with Kaizen Lightning Burst icon. Looking at the current state map of the company we could see large inventories, long total production lead time, every process had its own schedule and the flow was not lean. For Future state value stream mapping we used the guidelines below and answered some questions.

3.2.1.2.1 Producing to the takt time and to the maximum capacity. We have calculated the takt times of the product families before. This takt time was calculated from historical data, because it showed the current situation. It gave us a sense for the rate at which a process should be producing. We could see which processes need to improve. Producing to takt time required effort to provide fast response to problems, eliminate causes of unplanned downtime and eliminate changeover time in downstream assembly processes.

After we looked at the current state value stream of the company, we decided the new takt time for the future state, the line has to meet all demand values. We analysed historical demand data and decided to take forecasted maximum demand 500 unit. To reach this high value the line should work at Saturdays and 24 days in a month. We took the maximum capacity as 500 and working days as 24 for a month and calculated the takt time for the future state.

Quantity per day is 500/24=20.8.

The working time per day is 510 minutes. (one shift 8 hour minus 30 minutes break)

The takt time is 510 minutes / 20.8 pieces = 24.5 minutes

This means the line had to produce a part every 24 minutes to accomplish maximum customer needs and wants.

To produce to the takt time we had to balance the line according to the takt time, because each process have to be fast as required. Some process cycle times exceeded the takt time. Therefore, we decided to make a lean design for these processes. We increased the number of the processes and added some more processes. After that we arranged the number of operators according to the takt time. We calculated the number of processes and the number of operators for the takt time as below.

Forecasted Demand = 500

Cmax per day (1 shift 24 working days) = 500/24 = 21 unit.

Takt Time=510/21=24.5 min

Total processing time for the product family = 590 min.

Maximum number of operators should be 24. (590/24.5)

At the company there was a rule for line balancing, the maximum number of stations should be 1.3 times of the number of operators. Because of this the maximum number stations is 24*1.3 = 31.

After these calculations, we divided some operations to increase the process quantity and made an arrangement for the operator quantity. It can be seen in future state value stream map in Figure 3.5.

Table 3.3 The arrangement of operators to stations according to the analysis for the chosen product family

New Stations	Current Stations / Demand	DM1 A CT,VT 1250 A	
		500	
1	1. Station		
2/1	2. Station	1	16
2/2	3. Station	1	13
3/1	4. Station	1	24
3/2-3/3	5. Station	2	26
4/1-4/2	6. Station	1	24
5	7. Station	1	22
6	8. Station	1	25
7	9. Station	1	26
8	10. Station	1	35
9/1	11. Station	3	20
9/2	12. Station		22
10/1	13. Station		15
10/2	14. Station		20
11/1	15. Station	1	18
11/2	16. Station	1	15
12	17. Station	1	20
12	18. Station		12
13	19. Station		5
14/1	20. Station	1	15
14/2	21. Station		10
15/1	22. Station	1	22
15/2	23. Station	1	23
16	24. Station	1	14
17/1	25. Station	4	25
17/2	26. Station		25
18	27. Station	1	30
	Total Number of Operators	25	

We made this calculation not only for the product family under consideration but also for other main product types and for different demands. It can be seen in Table 3.4 and 3.5. But for future state value stream map we took into account only the product family's takt time, demand, number of operators and number of station analysis. They are in Table 3.3.

Table 3.4 Calculations of the number of processes and the number of operators for all product types and for different demands

	DM1A CT, VT 1250 A				IM, QM			
Demands	400	300	200	500	400	500	300	200
Number of Shifts	1 Shift	1 Shift	1 Shift	1 Shift	1 Shift	1 Shift	1 Shift	1 Shift
Working Days	20	20	20	24	20	20	20	20
Cmax per day	**20**	**15**	**10**	**21**	**20**	**25**	**15**	**10**
(Monthly Demand/Working Days for a Month)								
Takt Time	510	510	510	510	510	510	510	510
	20	15	10	21	20	25	15	10
	25,5 dak	**34,0** dak	**51,0** dak	**24,5** dak	**25,5** dak	**20,4** dak	**34,0** dak	**51,0** dak
Maksimum number of operators	590	590	590	590	435	435	435	435
	25,5	34,0	51,0	24,5	25,5	20,4	34,0	51,0
	23 opt	17 opt	12 opt	24 opt	17 opt	21 opt	13 opt	9 opt
Maksimum number of stations	30 sta	23 sta	15 sta	31 sta	22 sta	28 sta	17 sta	11 sta

	DM1A Level C				IM, QM Level C			
Demands	400	300	200	500	400	500	300	200
Number of Shifts	1 Shift	1 Shift	1 Shift	1 Shift	1 Shift	1 Shift	1 Shift	1 Shift
Working Days	20	20	20	20	20	20	20	20
Cmax per day	**20**	**15**	**10**	**25**	**20**	**25**	**15**	**10**
(Monthly Demand/Working Days for a Month)								
Takt Time	510	510	510	510	510	510	510	510
	20	15	10	25	20	25	15	10
	25,5 dak	**34,0** dak	**51,0** dak	**20,4** dak	**25,5** dak	**20,4** dak	**34,0** dak	**51,0** dak
Maksimum number of operators	300	300	300	300	215	215	215	215
	25,5	34,0	51,0	20,4	25,5	20,4	34,0	51,0
	12 opt	9 opt	6 opt	15 opt	8 opt	11 opt	6 opt	4 opt
Maksimum number of stations	15 sta	11 sta	8 sta	19 sta	11 sta	14 sta	8 sta	5 sta

	Mix (%21 Level C, %79 Level T + Level C)									
Demands	**400**		**300**		**200**		**500**		**580**	
Number of Shifts	1 Shift		1 Shift		1 Shift		1 Shift		1 Shift	
Working Days	20		20		20		20		20	
Cmax per day	**20**		**15**		**10**		**25**		**29**	
(Monthly Demand/Working Days for a Month)										
Takt Time	510		510		510		510		510	
	20		15		10		25		29	
	25,5	dak	**34,0**	dak	**51,0**	dak	**20,4**	**dak**	**17,6**	**dak**
Maksimum number of operators	465		465		465		465		465	
	25,5		34,0		51,0		20,4		17,6	
	18	opt	**14**	opt	**9**	opt	**23**	**opt**	**26**	**opt**
Maksimum number of stations	**24**	sta	**18**	sta	**12**	sta	**30**	**sta**	**34**	**sta**

Table 3.5 The arrangement of operators to stations according to the analysis for all product types

DEMAND-OPERATOR NUMBER TABLE

DM1A CT,VT 1250 A

Sta.	Demand	500		400		300		200	
1	1. Station			-					
2/1	2. Station	1	16	1		1			16
2/2	3. Station	1	13		29		29		13
3/1	4. Station	1	24	1	24	1	24	1	24
3/2-3/3	5. Station	2	26	2	26	1	40	1	40
4/1-4/2	6. Station	1	24	1	24	1	24		
5	7. Station	1	22	1	22	1	22	1	46
6	8. Station	1	25	1	25		25		
7	9. Station	1	26	1	26	1	26	1	51
8	10. Station	1	35	1	35	1	35	1	35
9/1	11. Station		20		20		20		
9/2	12. Station	3	22	3	22	2	22	1	42
10/1	13. Station		15		15		15		
10/2	14. Station		20		20		20	1	60
11/1	15. Station	1	18	1	18	1	18		
11/2	16. Station	1	15		15		15		
12	17. Station		20		20		20		
12	18. Station	1	12	1	12	1	12		
13	19. Station		5		5		5	1	60
14/1	20. Station		15		15		15	AG	
14/2	21. Station	1	10	1	10	1	10	Dolap	
15/1	22. Station	1	22	1	22	1	22		
15/2	23. Station	1	23		23		23		
16	24. Station	1	14	1	14	1	14	1	59
17/1	25. Station	4	25	4	25				
17/2	26. Station		25		25	3	34	2	50
18	27. Station	1	30	1	30	1	30	1	30
	Total Number of Operators	25		22		18		12	

IM, OM

Sta.	Demand	500		400		300		200	
1	1. Station	3	90	3	90	2	90	2	90
2/1	2. Station	1	16	1		1			16
2/2	3. Station	1	13		29		29		13
3/1	4. Station	1	24	1	24	1	24	1	24
3/2-3/3	5. Station	3	18	2	26	1	40	1	40
4/1-4/2	6. Station	1	15	1	15				15
5	7. Station	1	20	1	20	1	35		20
6	8. Station		3		3		3		3
7	9. Station	1	20	1	20	1	20	1	20
8	10. Station	-	-	-	-	-	-	-	-
9/1	11. Station		19		19		19		19
9/2	12. Station	1		2		2		1	
10/1	13. Station	1	17		17		17		17
10/2	14. Station	1	20		20		20		20
11/1	15. Station	-	-	-	-	-	-	-	-
11/2	16. Station	-	-	-	-	-	-	-	-
12	17. Station	-	-	-	-	-	-	-	-
12	18. Station	-	-	-	-	-	-	-	-
13	19. Station								
14/1	20. Station		15		15	Yukarıdaki			15
14/2	21. Station	1		1		kişi			
15/1	22. Station		15		15				15
15/2	23. Station	1							
16	24. Station	1	12	1	12	1	27	1	12
17/1	25. Station	2	25	2	25	2	25	1	50
17/2	26. Station								
18	27. Station	1	30	1	30	1	30	1	30
	Total Number of Operators	21		17		13		9	

DM1A Level C

Sta.	Demand	500		400		300		200	
1	1. Station								
2/1	2. Station	1	16	1		1			16
2/2	3. Station	1	13		29		29		13
3/1	4. Station	1	24	1	24	1	24	1	24
3/2-3/3	5. Station	3	18	2	26	1	40	1	40
4/1-4/2	6. Station	1	24	1	24	1	24		49
5	7. Station	1	25	1	25	1	25	1	
6	8. Station	1	20	1	20				
7	9. Station	1	20	1	20	1	40	1	40
8	10. Station	-	-	-	-	-	-	-	-
9/1	11. Station	-	-	-	-	-	-	-	-
9/2	12. Station	-	-	-	-	-	-	-	-
10/1	13. Station								
10/2	14. Station	1	25	1	25	1	25	1	25
11/1	15. Station	-	-	-	-	-	-	-	-
11/2	16. Station	-	-	-	-	-	-	-	-
12	17. Station	-	-	-	-	-	-	-	-
12	18. Station	-	-	-	-	-	-	-	-
13	19. Station								
14/1	20. Station	AG		AG		AG			
14/2	21. Station	Dolapta		Dolapta		Dolapta			
15/1	22. Station	1	15						
15/2	23. Station								
16	24. Station	1	15	1	30	1	30		
17/1	25. Station	-	-	-	-	-	-		
17/2	26. Station								
18	27. Station	1	25	1	25	1	25	1	55
	Total Number of Operators	14		11		9		6	

Mix (%21 Level C, %79 Level T + Level C)

Sta.	Demand	580		500		400		300		200	
1	1. Station	2	11	1	22	1	22		22		22
2/1	2. Station		15		15		15		15		15
2/2	3. Station	2	12	1	12	1	12	1	12	1	12
3/1	4. Station	2	12	1	24	1	24	1	24		60
3/2-3/3	5. Station	3	15	2	20	2	20	1	40	1	
4/1-4/2	6. Station	2	10	1	20	1	20				
5	7. Station	1	20	1	20	1	20	1	40	1	40
6	8. Station					1	16				
7	9. Station	2	12	1	22	1	22	1	38	1	38
8	10. Station	1	24	1	24	1	24	1	24		54
9/1	11. Station										
9/2	12. Station	2	15	2	15	1	30	1	30	1	
10/1	13. Station										46
10/2	14. Station	2	14	2	14	1	27	1	27	1	
11/1	15. Station	1	18	1	18		18		18		18
11/2	16. Station										
12	17. Station						9		9		9
12	18. Station						3		3		3
13	19. Station	1	17	1	17	1	5	1	5	1	5
14/1	20. Station									AG	
14/2	21. Station	1	19	1	19	1	19	1	19	Dolapta	
15/1	22. Station										
15/2	23. Station	2	15	2	15	1	30	1	30		30
16	24. Station	1	13	1	13	1	13	1	13	1	13
17/1	25. Station										
17/2	26. Station	3	20	3	20	2	32	2	32	1	60
18	27. Station	2	14	1	28	1	28	1	28	1	28
	Total Number of Operators	30		23		19		15		10	

3.2.1.2.2 *Developping continuous flow.* The mapping icon for continuous flow is simply the process box. In future state each process box should describe an area of flow. Two or more current state process boxes would be combined into one box on the future state map. We also used the pull or FIFO to combine processes for continuous flow. The end of the line was a continuous flow, because all finished goods were shipped without stocking, because the products were too big and need big stocking areas, so that a supermarket at this end did not make sense.

3.2.1.2.3 Using supermarkets to control production where continuous flow does not extend upstream. In value stream sometimes continuous flow could not be possible and batching will be necessary. At this system customer process goes to supermarket and withdraws what it needs when it needs it and supplying process produces to replenish what was withdrawn.

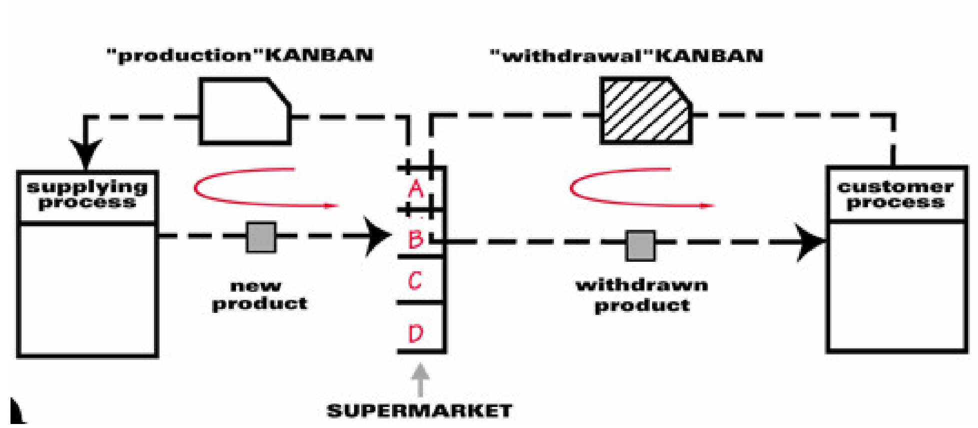


Figure 3.4 Supermarkets

For our case we applied continuous flow where it is possible, if not we put some supermarkets. We removed FIFO flows, because we planned to apply lean flow to these processes which had FIFO flow in current state. After lean project we limited the inventory between these processes to three with some signs on ground and some symbols. We can call these limited stock as buffer stock. We marked three rectangle on ground between processes. If all three rectangle were full with the product the supplying process had to stop production, otherwise it had to produce only for empty rectangles. With this application there would be maximum three products and inventories. To calculate this buffer stock we took into account the cycle times of the processes and the takt time of the line. Because this quantity was related with customer needs, we could not stop the line, if there will be a lot of orders. For future state we put supermarkets between subassembly processes and main processes. With these supermarkets we wanted to limit the inventory. We will analyse it later, at Kaizen Blitz application, because after current state drawing there is a need to make a Kaizen Blitz project for subassembly processes to make the flow lean between subassembly and main assembly processes. The supermarket icon was open on the left side which face the supplying process. Because this supermarket belongs to the supplying process and is used to schedule that process.The customer process comes to the supplier's supermarket and withdraws what is needed.

3.2.1.2.4 Trying to send the customer schedule to only one production process. By using supermarkets we need to schedule only one point in our value stream. This point was called pacemaker process, because how we control production at this process sets the pace for all the upstream processes. On the future state map the pacemaker was the production process that is controlled by the outside customer's orders. For our future state the pacemaker process was the first and the second processes. With supermarkets and buffer stocks the pacemaker process triggered all other processes.

3.2.1.2.5 Distributing the production of different products evenly over time at the pacemaker process, levelling the production mix. In manufacturing generally grouping and batching the same product type is preferred. But grouping the same product and producing them all at once makes it difficult to serve customers who want something different from the batch being produced now. This requires to have more finished goods inventory or more lead time to fulfill an order. Leveling the product mix is distributing the production of different products over a time period. The icon of leveling is inserted into an information flow arrow. O X O X

For the company the planning department gave weekly plan to production department. We can see an example of this plan in figure 3.6. This plan contained the customer orders in an order with their priorities and with their shipping dates. After that the production responsible level the products in a day according to the product types of orders. Because all the product types did not pass through all processes and did not have equal process cycle times. To increase overall process efficiency and to decrease the idle time of the processes level loading was necessary.

Table 3.6 An example of company's production plan

PRODUCTION PLAN OF WEEK X

PRODUCTION DATE	JOB NO	JOB DESCRIPTION	Order	Storage Location	51000148AE	51000148F	51000148G	51000148M	51000148P	51000148Y	51254407A	51254407AD	51254407AS	51254407AV	51254407AW	51254407AY	51254407AZ	51254407E	51254407U	51254520A	51254567A	51254567F	51254567M	TOTAL QUANTITY	DELIVERY DATE	CAPACITY USAGE
				ORDER NO	1076712	1076713	1076714	1076715	1076716	1076717	1076718	1076719	1076720	1076721	1076722	1076723	1076724	1076725	1076726	1076728	1076729	1076731	1076732			
					TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS	TYPES OF PRODUCTS			Coefficient
xx.xx.xxxx Pazartesi	CEZAYİR	CEZAYİR	2024540	CEZAYİR			3		2															5	xx.xx.xxxx	
xx.xx.xxxx Pazartesi	E28103.13/1	XXXXXX,		P076							6			2			2		1		1	1		13	xx.xx.xxxx	
xx.xx.xxxx Pazartesi	Y28276.13	XXXXXX,	1008678	S306							2	1		1										4	xx.xx.xxxx	
		TOPLAM					3		2		8	1		3			2		1		1	1		22		74%
xx.xx.xxxx Salı	Y28277.13	XXXXXX,	1008679	S307							4			2										6	xx.xx.xxxx	
xx.xx.xxxx Salı	Y28278.13	XXXXXX,	1008680	S308							2			1			1							4	xx.xx.xxxx	
xx.xx.xxxx Salı	M28007.13	XXXXXX,		P391							1							1			1	1		4	xx.xx.xxxx	
xx.xx.xxxx Salı	FRANSA	FRANSA	2025562	FRANSA		1	2			1										2				6	xx.xx.xxxx	
xx.xx.xxxx Salı	FRANSA	FRANSA	2025518	FRANSA	1	1		1																3	xx.xx.xxxx	
		TOPLAM			1	2	2	1		1	7			3			1	1		2	1	1		23		70%
xx.xx.xxxx Çarşamba	FRANSA	FRANSA	2025518	FRANSA			3			1														4	xx.xx.xxxx	
xx.xx.xxxx Çarşamba	E28086.13	XXXXXX,		P052							7			4			6						1	18	xx.xx.xxxx	
		TOPLAM					3			1	7			4			6						1	22		82%
xx.xx.xxxx Perşembe	E28086.13	XXXXXX,		P052							13													13	xx.xx.xxxx	
xx.xx.xxxx Perşembe	E28094.13/2	XXXXXX,		P049									2	4			3							9	xx.xx.xxxx	
		TOPLAM									13		2	4			3							22		87%
xx.xx.xxxx Cuma	E28094.13/2	XXXXXX,		P049							10													10	xx.xx.xxxx	
xx.xx.xxxx Cuma	Y28296.13	XXXXXX,	1008753	S315											2	2	2							6	xx.xx.xxxx	
xx.xx.xxxx Cuma	Y28298.13	XXXXXX,	1008755	S317							3	1			1		1							6	xx.xx.xxxx	
xx.xx.xxxx Cuma	Y28305.13	XXXXXX,	1008760	S322							1	1												2	xx.xx.xxxx	
		TOPLAM									14	2			3	2	3							24		89%
		GENEL TOPLAM			1	2	8	1	2	2	49	3	2	14	3	2	15	1	1	2	2	2	1	113		80%

3.2.1.2.6 Defining necessary process improvements. For future state we noted any equipment and procedural improvements that will be necessary, we used the Kaizen lightning burst for this. For the future state value stream map Kaizen project for the subassembly processes, lean design for the line and for the bottleneck process (here this was FQC process) , MPH for finished goods and for raw material were necessary improvements.

We finished the company's future state map. (Figure 3.5) For future state after the accomplishment of improvements and the projects, we improved the production lead time and the processing time for the line. The new production lead time was 4.21 days and the new processing time was 7 hours and 44 minutes.

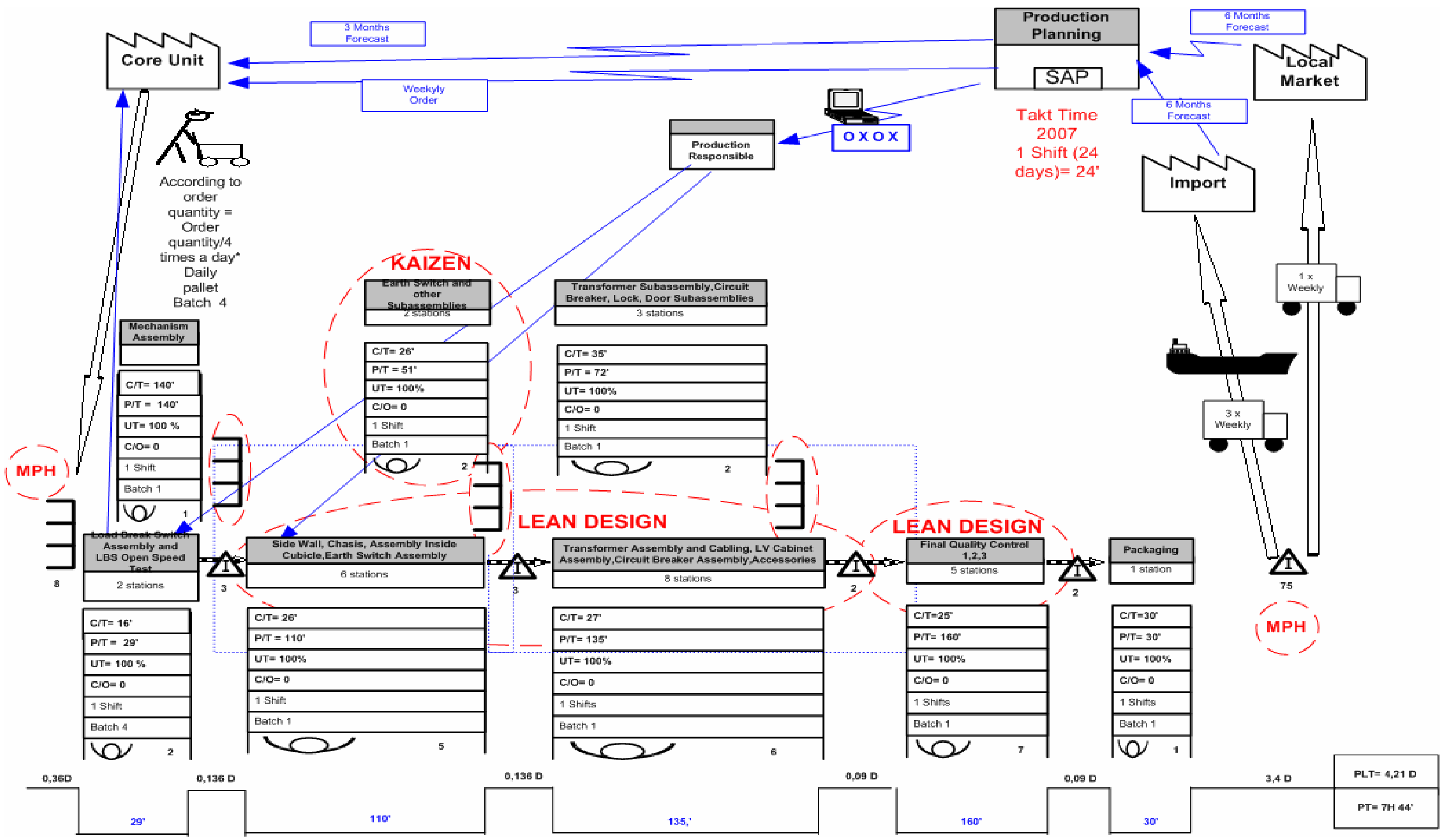


Figure 3.5 Future state value stream map of the company

After explanation the value stream of the line and the need for a Kaizen Blitz project, we started to analyse the Kaizen Blitz Project.

3.2.2 The Kaizen Bilitz Project of the Company

As we have mentioned before Kaizen Blitz is a process improvement method that produces real improvements in a predefined area in just 2 or 3 days. For the Kaizen Blitz project we chose the subassembly processes, because while value stream analysis we have seen that these processes had some design and flow problems. The reason of making Kaizen Blitz project to solve these problems was to make continuous improvements for health and safety, quality, efficiency, material and information flow, space usage and to optimize the value stream. The analysis must be conducted by a team, to optimize value-added time. This team included operators and any other relevant support staff (maintenance, methods engineering, logistics, quality, etc.)

The kaizen blitz project has made in a deming cycle. We started with the planning stage and identified what to changed and how to do it. After that at do stage we executed the improvement and ensured the improvements works at check stage. Finaly at act stage we wrote the actions for the future and for the ongoing improvements.

The Kaizen Blitz projects should have a project manager, this person do the preparations, collect the data, organize the event and the team, get necessary equipments and follow the action plan. I was the project manager for the company's Kaizen Blitz project.

For the event and for the analysis the team need some data, these data should be collected before the project started. At these 3 days event some equipments were necessary. For necessary equipments and data, we had a check list for Kaizen Blitz. The Check list is below in Table 3.7.

Kaizen is a project and there must be a project sheet to highlight all aspects for the team members, for the managers and for other departmants of the factory. In this sheet the aim, expected results, the plan, the organisation, the budget, the risks and the indicators of the project should be highlighted and followed. The project sheet of this Kaizen Project is in table 3.8.

Table 3.7 Check list

CHECK LIST for a KAIZEN BLITZ
Product : Sub Assemblies of The Line

	Resp	Date	Status
Product Data :			
- Product families	HAN	27.04.07	OK
- Quantity per family	HAN	27.04.07	OK
- Seasonality curve	TUC	27.04.07	
- Distribution of the past orders	HAN	27.04.07	OK
- Forecasted quantities for next 3 years	HAN	27.04.07	OK
- Product BOM (bill of materials)	HAN	27.04.07	OK
- FMR Analysis for the components	HAN	27.04.07	OK
- Assembly routines with useful time and non value added times	HAN	27.04.07	OK
- Cost breakdown per product family	TUC	27.04.07	
- Number of defective parts.	FAS	27.04.07	OK
- Layouts	ERD	27.04.07	OK
- Shooting of the movie of the operations	HAN	27.04.07	OK
Indicators :			
- Time per operation	HAN	27.04.07	OK
- IE validate UT	HAN	27.04.07	OK
- WIP stocks	HAN	27.04.07	OK
- Takt time	HAN	27.04.07	OK
- Cmax	HAN	27.04.07	OK
- Actual NQC & MDR	FASI	27.04.07	OK
Logistic :			
- Parts per workstation	HAN	27.04.07	OK
- Surface requirements analysis	HAN/ERD	27.04.07	
- VSM	HAN	27.04.07	OK
Kaizen Organization :			
- Definition of the Participants	HAN	27.04.07	OK
- Organize sub-contractor for re-organization (if necessary)	HAN	27.04.07	
- Keep the stations non - working during the Kaizen	GOU/ HAN	27.04.07	OK
- Required organization for night stays (if necessary)	HAN	27.04.07	OK
- Organization of the labor according to the Law.	HAN	27.04.07	OK
- Keep ready all method and maintenance teams during Kaizen Event	YIB	27.04.07	OK
- Arrange 2 meeting rooms during Kaizen event	HAN	27.04.07	OK
- Organization of coffee breaks	HAN	27.04.07	OK
- Organization the dinner for the 2nd day evening.	HAN	27.04.07	OK

Equipments for Kaizen Blitz				
Items	**Quan.**	**Resp.**	**Date**	**Status**
- Board	3	HAN	07.05.07	OK
- Board markers (4 colors)	2	HAN	07.05.07	OK
- Board markers (Black)	10	HAN	07.05.07	OK
- Pencils	20	HAN	07.05.07	OK
- Règle 30 cm	2	HAN	07.05.07	OK
- Meter	4	HAN	07.05.07	OK
- Eraser	4	HAN	07.05.07	OK
- Scissors	1	HAN	07.05.07	OK
- Adhesive type	2	HAN	07.05.07	OK
- Pin	5	HAN	07.05.07	OK
- Adhesives	2	HAN	07.05.07	OK
- Papier kraft 1200*1500	10	HAN	07.05.07	OK
- Layout of actual state (A0)	4	ERD	07.05.07	OK
- Post-it de taille 127 X 78 pour le Metaplan	8 blocs	HAN	07.05.07	OK
- Calculator	2	HAN	07.05.07	OK
- Projector	1	HAN	07.05.07	OK

Table 3.8 Kaizen project sheet

<u>KAIZEN PROJECT SHEET</u>

PROJECT: 3-days Kaizen SM6 SUB-ASSEMBLY

SPONSOR: M. ÖZBİLEN **PROJECT MANAGER: H. ÜNALAN**

GENERATING FACT

- Modify Subassembly stations according to the Lean concept.
- First KAIZEN Methodology implementation for SM6-36
- Saving of space.
- To realize SPS action plan.
- To improve the working conditions.

AIMS / STAKES

- Make a gap to reach savings very quickly
- Implement SPS principles in a very short time with low investment, line architecture, SIM, MPH.

EXPECTED RESULTS / DELIVERABLES

- Improvement of KE and KD
- Reduction of unnecessary movements.
- Better layout
- Reduction of the WIP Stocks.

PROJECT PLANNING

▪ Current state	April/May 07
▪ Starting working group	8th May 07
▪ Restitution	9th May 07
▪ Validation	9th May 07
▪ Implementation	Night 9th May. 07
▪ Result measures	from 10th May 07

PROJECT ORGANIZATION

Working group: Y.Bakiş, G.Ünlü, Z.Taylan, E.Altunlu, N.O.Aydın, F.Özgür, Ö.Dönmez, A.Akgün, M. Yılmaz, O.Yenigün, F.Şimşek, H.Ünalan, A.Çimen, T.Ciğeroğlu,

Management group : M.Özbilen

BUDGET / MEANS

- 5 K€

DATA TO GATHER

- Assembly time and KD
- Production Quantities History (Cmax, Takt Time Calculation)
- FMR Analysis for the components.
- WIP stocks.
- Areas
- Layout (1. Plant 2. Sub Assembly stations)
- Product Family and BOM

IDENTIFIED RISKS

- Difficulty to deal lots of operations and references

WHAT IS NECESSARY FOR SUCCESS

- The way the members of the group stick together
- Plant management support the project
- Great capacity to challenge
- Involvement of support functions
- Change culture

RESULTS INDICATORS

- KE / KD
- Areas
- WIP Stocks
- LT

After the preparations of the Kaizen sheets, we started gathering necessary data for the implementation.

3.2.2.1 Necessary Data for Kaizen Blitz Project

First necessary data for the project was the value stream maps of the line. We have finished mapping before the project and decided to do the Kaizen Blitz project to this area after analyzing the whole value stream. Drawing the value stream maps helped us by finding wastes and non value added operations.

The subassembly processes did not produce parts for all types of products. Because of this the product family chart for the subassembly processes should be prepared for the analysis of the flow. We showed the subassembly processes and related products and also the parts which were used to make this subassembly (BOM of the subassemlies) in product family chart. The parts and materials were necessary for the material providing and handling analysis. In Table 3.9 we can see the summarised product family without the subassembly BOMs and in table 3.10 one part of the whole product family chart with the subassembly BOMs is shown (only for one product type). We could not show the whole chart, because it is too big and there are a lot of product types and subassembly processes. Therefore as an example we showed only one product type to explain the table.

Table 3.9 Product family chart of subassembly processes

Process	Quantity for a product	PRODUCTS																				
		DM1A (630)	DM1A (1250)	OM, PM (630)	CMC	DM2	CM(630)	IM,SM (630)	SM (1250)	GAM2 (630)	GAM2 (1250)	GAM2 PLUS	GAM (630)	GAM (1250)	GBCA (630)	GBCA (1250)	GBCB (630)	GBCB (1250)	GBM (630)	GBM (1250)	IMB	IMC (630)
TLP 190 Taban	1		X																			
TLP 160 Taban	1	X																				
Kelepçe (630-1250)	3	X	X	X				X	X	X	X	X	X	X								X
Orta Dikme	1	X	X		X																	
Manivela Hazırlık	1	X	X										X	X								
Ayarlı Biyel Hazırlık	1					X																
Sigorta Altı Komplesi Hazırlık	3			X																		
Sigorta Kontak Pensi	3			X	X		X															
Gerilim Gösterge Hazırlık	1	X	X							X	X	X										
Üst Bağlantı	3	X	X		X	X	X	X													X	X
Topay Mekanizma Hazırlık	1	X	X	X									X	X								
Kaynaklı Mil - Bıçak	1	X	X										X	X								
Ön Mekanizma	1			X																		
Arka Mekanizma	1			X																		
Lale Kontak	3			X																		
Örgülü Bakır	1			X																		
Topay Alan Düzenleyici	3	X	X										X									
İzalotör Hazırlık	1	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Takoz	3			X																		
Topay Mekanizma Montaj	1	X	X	X									X	X								

Table 3.10 Product family with the subassembly BOM (for one product type)

			PRODUCTS	
Process	**Reference**	**Quantity for a product**	**DM1A (630)**	**DM1A (1250)**
TLP 190 Taban Saçı Hazırlık		1		Arka Taban Saçı - 51257275 - 1 adet
				Orta Taban Saçı - 51257276 - 2 adet
				Ön Taban Saçı - 51257282 - 1 adet
				LTP Ön Taban Saçı - 51257277 - 3 adet
				Alt Destek Saçı - 51257278 - 1 adet
				LTP 190 Taşıyıcı - 51257280 - 1 adet
				LTP 190 Taşıyıcı - 51257279 - 2 adet
				Kablo Kelepçesi - 3736481 - 6 adet
				Kauçuk Körük - 1781757 - 7 adet
				Perçin - 21130006 - 8 adet
				Kontak Rondela - 1023793 - 12 adet
				Kafesli Somun - 21286006B - 18 adet
				Civata - 21431187 - 12 adet
				Civata - 21431224 - 12 adet
				Kablo Destek Saçı - 51000596 - 3 adet
TLP 160 Taban Saçı Hazırlık		1	Orta Taban Saçı - 51257681 - 2 adet	
			Ön Taban Saçı - 51257682 - 1 adet	
			Arka Taban Saçı - 51257683 - 1 adet	
			Alt Destek Saçı - 51257686 - 1 adet	
			LPCT Taşıyıcı - 51256305 T0 - 5 adet	
			Perçin - 21130006 - 8 adet	
			Civata - 21431187 - 9 adet	
			Kafesli Somun - 21286006B - 16 adet	
			Kontak Rondela - 1023793 - 9 adet	
			51257242 - 8 adet	
Kelepçe (630-1250)		3	Kablo Destek Saçı - 3735543 - 1 adet	Kablo Destek Saçı - 51000596 - 1 adet
			Kablo Kelepçesi - 3736481 - 1 adet	Kablo Kelepçesi - 3736481 - 2 adet
			Civata - 21431224 - 2 adet	Civata - 21431224 - 4 adet
			Kontak Rondela - 1023797 - 2 adet	Kontak Rondela - 1023797 - 4 adet
			Kafes Somun - 21286008B - 2 adet	Kafes Somun - 21286008B - 4 adet
Orta Dikme Hazırlık	51000504 - CMC 3735627 - DM1A	1	Çengel - 3728290 - 4 adet	Çengel - 3728290 - 4 adet
			Perçin - 21130006 - 8 adet	Perçin - 21130006 - 8 adet
			Orta Dikme - 51000504 - 1 adet - CMC	Orta Dikme - 51000504 - 1 adet - CMC
			Orta Dikme - 3735627 - 1 adet - DM1A	Orta Dikme - 3735627 - 1 adet - DM1A
			Somun - 21286006B - 2 adet	Somun - 21286006B - 2 adet
Manivela Hazırlık		1	Somun - 21253105 - 2 adet	Somun - 21253105 - 2 adet
			Civata - 21431158 - 2 adet	Civata - 21431158 - 2 adet
			Rondela - 1023792 - 2 adet	Rondela - 1023792 - 2 adet
			Yüzük - 1796860 - 1 adet	Yüzük - 1796860 - 1 adet
			Yükay Yatak - 3730677 - 1 adet	Yükay Yatak - 3730677 - 1 adet
			Manivela - 3730678 - 1 adet	Manivela - 3730678 - 1 adet
			Tespit Burcu - 3730679 - 1 adet	Tespit Burcu - 3730679 - 1 adet
			Takviye - 3730676 - 1 adet	Takviye - 3730676 - 1 adet
Gerilim Gösterge Hazırlık		1	Gerilim Gösterge Buatı - 59904 - 1 adet	Gerilim Gösterge Buatı - 59904 - 1 adet
			Buat Taşıma Saçı - 51257950 - 1 adet	Buat Taşıma Saçı - 51257950 - 1 adet
			Civata - 21362095 - 2 adet	Civata - 21362095 - 2 adet
Üst Bağlantı		3	Üst Bağlantı - 3736435 - 1 adet	Üst Bağlantı - 3736435 - 1 adet
			Somun - 21253112 - 1 adet	Somun - 21253112 - 1 adet
			Kontak Rondela - 1023804 - 1 adet	Kontak Rondela - 1023804 - 1 adet
Topay Mekanizma Hazırlık		1	Arka Plaka - 3735607 - 1 adet	Arka Plaka - 3735607 - 1 adet
			Ön Plaka - 3735606 - 1 adet	Ön Plaka - 3735606 - 1 adet
			Manivela - 3735608 - 1 adet	Manivela - 3735608 - 1 adet
			Mekanizma Pimi - 3735612 - 1 adet	Mekanizma Pimi - 3735612 - 1 adet
			Plaka Bağlantı Parçası - 3735611 - 3 adet	Plaka Bağlantı Parçası - 3735611 - 3 adet
			Manevra Burcu - 3735617 - 1 adet	Manevra Burcu - 3735617 - 1 adet
			Yay - 3730875 - 2 adet	Yay - 3730875 - 2 adet
			Yay Klavuzu - 3735609 - 2 adet	Yay Klavuzu - 3735609 - 2 adet
			Yay Klavuzu - 3735610 - 2 adet	Yay Klavuzu - 3735610 - 2 adet
			Yarıklı Pim - 21167162 - 1 adet	Yarıklı Pim - 21167162 - 1 adet
			Yarıklı Pim - 21167222 - 1 adet	Yarıklı Pim - 21167222 - 1 adet
			Somun - 21285208 - 7 adet	Somun - 21285208 - 7 adet

Process	Reference	Quantity for a product	DM1A (630)	DM1A (1250)
Kaynaklı Mil - Bıçak		1	Kaynaklı Mil - 3735602 - 1 adet	Kaynaklı Mil - 3735602 - 1 adet
			Perçin - 21130005 -18 adet	Perçin - 21130005 -18 adet
			Somun - 21285206 - 3 adet	Somun - 21285206 - 3 adet
			Baskı Yayı - 3930012 - 3 adet	Baskı Yayı - 3930012 - 3 adet
			Burç - 51000501 - 3 adet	Burç - 51000501 - 3 adet
			Civata - 21431195 - 3 adet	Civata - 21431195 - 3 adet
			Manyetik Koruyucu - 3735615 - 6 adet	Manyetik Koruyucu - 3735615 - 6 adet
			Bıçak - 3735605 - 6 adet	Bıçak - 3735605 - 6 adet
			Somun - 21253106 - 12 adet	Somun - 21253106 - 12 adet
			Civata - 21431188 - 12 adet	Civata - 21431188 - 12 adet
			Kontak Rondela - 1023793 - 12 adet	Kontak Rondela - 1023793 - 12 adet
			Somun - 21253108 - 5 adet	Somun - 21253108 - 5 adet
			Kontak Rondela - 1023797 - 10 adet	Kontak Rondela - 1023797 - 10 adet
			Civata - 21431219 - 5 adet	Civata - 21431219 - 5 adet
			Düz Rondela - 21222306 - 6 adet	Düz Rondela - 21222306 - 6 adet
			Topay Kollektör - 3730747 - 1 adet	Topay Kollektör - 3730747 - 1 adet
Topay Alan Düzenleyici		3	Allen Civata - 21528188 - 1 adet	Allen Civata - 21528188 - 1 adet
			Çan - 3730700 - 1 adet	Çan - 3730700 - 1 adet
			Civata - 21528220 - 1 adet	Civata - 21528220 - 1 adet
			Civata - 21431221 - 1 adet	Civata - 21431221 - 1 adet
			Yastık - 3930816 - 1 adet	Yastık - 3930816 - 1 adet
			Sabit Kontak - 3930818 - 1 adet	Sabit Kontak - 3930818 - 1 adet
			Kontak Desteği - 3735623 - 1 adet	Kontak Desteği - 3735623 - 1 adet
			Somun - 21253108 - 1 adet	Somun - 21253108 - 1 adet
			Kontak Rondela - 1023797 - 2 adet	Kontak Rondela - 1023797 - 2 adet
			Kontak Rondela - 1023793 - 1 adet	Kontak Rondela - 1023793 - 1 adet
İzalotör Hazırlık	51000011A - QM 51000011D-DM2 51000011B-GAM2	1	Topay Saçı - 51257237 - 1 adet	Topay Saçı - 51257237 - 1 adet
			Civata - 21431281 - 12 adet	Civata - 21431281 - 12 adet
			Rondela - 1023804 - 12 adet	Rondela - 1023804 - 12 adet
			İzalotör - 51257952A - 3 adet	İzalotör - 51257952A - 3 adet
Topay Mekanizma Montaj	51000113A 51000113B	1	Kontak Rondela - 1023790 - 6 adet	Kontak Rondela - 1023790 - 6 adet
			Civata - 21431251 - 6 adet	Civata - 21431251 - 6 adet
			Civata - 21431188 - 4 adet	Civata - 21431188 - 4 adet
			Somun - 21253106 - 4 adet	Somun - 21253106 - 4 adet
			Kontak Rondela - 1023793 - 8 adet	Kontak Rondela - 1023793 - 8 adet
			İzole Levha - 3735784 - 1 adet	İzole Levha - 3735784 - 1 adet
			Plastik Perçin - 8 adet	Plastik Perçin - 8 adet
			Yarıklı Pim - 21167162 - 1 adet	Yarıklı Pim - 21167162 - 1 adet
			Yarıklı Pim - 21167122 - 1 adet	Yarıklı Pim - 21167122 - 1 adet
			İzalator Komplesi	İzalator Komplesi
			İzalotör Alan Düzenleyici - 3735574 - 3 adet	İzalotör Alan Düzenleyici - 3735574 - 3 adet
			Mekanizma	
			Alan Düzenleyici	
			Kaynaklı Mil hazırlıkları	
Ön Mekanizma		1		
Arka Mekanizma		1		
Ayarlı Biyel Hazırlık	373562 - DM1A 151000144 A - Kuplaj	1		
Sigorta Altı Komplesi Hazırlık		3		
Sigorta Kontak Pensi		3		
Lale Kontak		3		
Örgülü Bakır	3735583	1		
Takoz		3		

We made video analysis for the subassemly operations and calculated the useful times, design times and efficiency coefficient KD. The result of the analysis is below. The values changed after the project implementation and the improvements. At the end of the Kaizen Blitz project we made the measurements again and saw the results and benefits.

Table 3.11 The results of video analysis

	Useful (Green) Time UT	Red Time	Design (Total) Time DT	KD = UT/DT Before the Project (Current)
TLP 190 Taban Saçı Hazırlık	625	350	975	64,10
TLP 160 Taban Saçı Hazırlık	345	250	595	57,98
Kelepçe (630) - 3 adet için	143	107	250	57,20
Kelepçe (1250) - 3 adet için	245	75	320	76,56
Orta Dikme Hazırlık (CMC)	77	53	130	59,23
Orta Dikme Hazırlık (DM1A)	70	180	250	28,00
Manivela Hazırlık	120	186	306	39,22
Ayarlı Biyel Hazırlık (DM1A)	17	48	65	26,15
Ayarlı Biyel Hazırlık (DM2)	60	266	326	18,40
Sigorta Altı Komplesi Hazırlık (3 adet)	345	200	545	63,30
Sigorta Kontak Pensi (3adet)	170	100	270	62,96
Gerilim Gösterge Hazırlık	33	27	60	55,00
Üst Bağlantı (3 adet)	34	32	66	51,52
Topay Mekanizma Hazırlık	286	340	626	45,69
Bıçak (3 adet)	215	350	565	38,05
Kaynaklı Mil	320	90	410	78,05
Ön Mekanizma	255	315	570	44,74
Arka Mekanizma	58	118	176	32,95
Lale Kontak (3 adet)	250	200	450	55,56
Örgülü Bakır	71,35	26,65	98	72,81
Topay Alan Düzenleyici (3 adet)	307	228	535	57,38
İzalotör Hazırlık + Topay Mkn. Montaj	665	635	1300	51,15
Takoz	30	44	74	40,54

Historical demand data was one of the necessary data to analyse customer exact needs for these subassembly products, we used this data to design the stations according to the customer needs. The processes had to be designed to meet maximum demand value, we looked at the historical demands and found the maximum capacity to meet maximum demand. To calculate maximum capacity we looked the monthly demands for the past two years and took the maximum value, after that we multiplied this value with 1.2. Because we thought for the future , the forecasted demand could exceed the past demands and took a coefficient for this as

1.2, it means the forecasted demand could be %20 percent more from historical data. Historical demand data and the maximum capacity data are below.

Table 3.12 Historical demand data and the maximum capacity data

	2003	2004	2005	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Total 06	Jan-07	Feb-07	Mar-07	Apr-07	Total 07	Total	Cmax
TLP 190 Taban Saçı Hazırlık	0	0	37	2	9	14	17	3	30	9	0	23	6	18	10	141	6	4	13	8	31	209	36
TLP 160 Taban Saçı Hazırlık	0	0	199	93	147	84	173	98	181	160	109	119	134	134	155	1587	91	93	149	145	478	2264	217,2
Kelepçe (630,1250)	3525	5067	6648	642	849	897	927	609	1143	732	489	606	660	708	747	9009	525	612	774	819	2730	26979	1371,6
Orta Dikme Hazırlık	553	1057	1351	120	198	121	228	126	245	202	121	178	167	180	189	2075	110	125	201	176	612	5648	294
Manivela Hazırlık	432	827	1102	95	156	101	190	103	211	169	109	143	144	152	165	1738	98	97	162	154	511	4610	253,2
Ayarlı Biyel Hazırlık	438	839	1138	98	178	107	208	107	226	184	115	158	148	157	171	1857	97	109	173	165	544	4816	271,2
Sigorta Altı Komplesi Hazırlık	594	720	933	111	111	123	36	33	156	48	33	9	54	12	51	777	36	75	15	162	288	3312	194,4
Sigorta Kontak Pensi	642	1002	1215	123	171	171	135	60	216	90	48	96	99	84	108	1401	69	108	66	198	441	4701	259,2
Gerilim Gösterge Hazırlık	493	921	1232	105	174	116	217	114	242	200	120	153	149	179	181	1950	113	105	172	161	551	5147	290,4
Üst Bağlantı	3123	4791	6171	588	879	810	978	624	1050	735	477	720	672	720	738	8991	477	633	870	729	2709	25785	1260
Topay Mekanizma Hazırlık	432	827	1102	95	156	101	190	103	211	169	109	143	144	152	165	1738	98	97	162	154	511	4610	253,2
Kaynaklı Mil - Bıçak	432	827	1102	95	156	101	190	103	211	169	109	143	144	152	165	1738	98	97	162	154	511	4610	253,2
Ön Mekanizma	198	240	306	37	35	41	12	11	40	16	11	3	18	4	17	245	12	25	5	54	96	1085	64,8
Arka Mekanizma	198	240	306	37	35	41	12	11	40	16	11	3	18	4	17	245	12	25	5	54	96	1085	64,8
Lale Kontak	594	720	933	111	111	123	36	33	156	48	33	9	54	12	51	777	36	75	15	162	288	3312	194,4
Örgülü Bakır	198	240	306	37	35	41	12	11	40	16	11	3	18	4	17	245	12	25	5	54	96	1085	64,8
Topay Alan Düzenleyici	1296	2481	3306	285	468	303	570	309	633	507	327	429	432	456	495	5214	294	291	486	462	1533	13830	759,6
İzalotör Hazırlık	1307	1946	2548	246	351	335	365	239	437	293	183	260	257	274	286	3526	195	246	313	313	1067	10394	524,4
Takoz	594	720	933	111	111	123	36	33	156	48	33	9	54	12	51	777	36	75	15	162	288	3312	194,4
Topay Mkn. Montaj	630	1067	1413	132	193	142	202	114	263	185	120	146	162	156	182	1997	110	122	167	208	607	5714	315,6

From historical demand data takt times for the past realised demands and for the forecasted maximum capacity of the processes were calculated. We got processing lead times for the operations from this calculation. Total production lead time is the sum of inventory waiting times. Lead time was calculated by dividing the inventory and work in process quantity to the daily customer requirement. This time was the production waiting time. For Kaizen Blitz processes we counted the work in process parts as inventory and divided them to the realised daily quantities. These WIP values were for the subassembly parts, not for the raw materials. The takt times, the lead times of the processes and work in process quantities for the subassembly parts are in table 3.13 below.

For material providing and handling the work in process quantities for raw materials should be examined. For raw material WIP quantities we counted current raw material quantities on the workstations. To do this we looked at the current box quantities. Because the company used two boxes system for the material handling and providing system. At workstations and at warehouse shelves there were two boxes for all raw materials. Every two hour material provider replenished the workstations with train, he looked at the boxes, if he saw an empty box, he took the box. He brought the box to the warehouse, left the empty box on the shelves and took the full one. At other loop of replenishment he left the full box to the station. For the warehouse man the process was the same, he controlled the shelves, if he saw an empty box, he filled up the boxes. After that to find how many daily stocks we had, we divided these WIP quantities to the maximum daily capacity. Maximum daily capacity was calculated in the same way as we explained before. We looked at historical consumption quantities, took maximum monthly quantity and multiplied this quantity with 1.2 and divided to the working days in a month. We used these WIP values to find new design improvements on stock values. We had two different raw material work in process quantities to see the improvements better. One included small raw materials like the screws and rivets, the other one did not include these raw materials. The maximum capacities are in table 3.14 and the raw materials work in process quantities are in table 3.15 (screws and rivets are included) and in table 3.16(screws and rivets are not included).

Table 3.13 The takt times, the lead times of the subassembly processes and work in process quantities for the subassembly parts

	Quantity (2006)	Quantity (2007)	Total	Working Days (Total 2006, 2007)	Daily Quantity	Shift	Working Time (min)	Takt Time Realised (Working time/daily quantity)	Monthly Cmax	Yearly Cmax	Daily Cmax	Takttime for the Cmax (Working time/daily quantity)	Before WIP for the current situation	PLT - Before	
TLP 190 Taban Saçı Hazırlık	141	31	172	329	0,52	1	510	975,523	36	432	1,8	283,33	6	11,48	days
TLP 160 Taban Saçı Hazırlık	1587	478	2065	329	6,28	1	510	81,254	217,2	2606,4	10,86	46,96	6	0,96	days
Kelepçe (630,1250)	9009	2730	11739	329	35,68	1	510	14,293	1371,6	16459,2	68,58	7,44	35	0,98	days
Orta Dikme Hazırlık	2075	612	2687	329	8,17	1	510	62,445	294	3528	14,7	34,69	25	3,06	days
Manivela Hazırlık	1738	511	2249	329	6,84	1	510	74,606	253,2	3038,4	12,66	40,28	20	2,93	days
Ayarlı Biyel Hazırlık	1857	544	2401	329	7,30	1	510	69,883	271,2	3254,4	13,56	37,61	10	1,37	days
Sigorta Altı Komplesi Hazırlık	777	288	1065	329	3,24	1	510	157,549	194,4	2332,8	9,72	52,47	30	9,27	days
Sigorta Kontak Pensi	1401	441	1842	329	5,60	1	510	91,091	259,2	3110,4	12,96	39,35	20	3,57	days
Gerilim Gösterge Hazırlık	1950	551	2501	329	7,60	1	510	67,089	290,4	3484,8	14,52	35,12	12	1,58	days
Üst Bağlantı	8991	2709	11700	329	35,56	1	510	14,341	1260	15120	63	8,10	30	0,84	days
Topay Mekanizma Hazırlık	1738	511	2249	329	6,84	1	510	74,606	253,2	3038,4	12,66	40,28	10	1,46	days
Kaynaklı Mil - Bıçak	1738	511	2249	329	6,84	1	510	74,606	253,2	3038,4	12,66	40,28	26	3,80	days
Ön Mekanizma	245	96	341	329	1,04	1	510	492,053	64,8	777,6	3,24	157,41	24	23,16	days
Arka Mekanizma	245	96	341	329	1,04	1	510	492,053	64,8	777,6	3,24	157,41	20	19,30	days
Lale Kontak	777	288	1065	329	3,24	1	510	157,549	194,4	2332,8	9,72	52,47	20	6,18	days
Örgülü Bakır	245	96	341	329	1,04	1	510	492,053	64,8	777,6	3,24	157,41	40	38,59	days
Topay Alan Düzenleyici	5214	1533	6747	329	20,51	1	510	24,869	759,6	9115,2	37,98	13,43	50	2,44	days
İzalotör Hazırlık	3526	1067	4593	329	13,96	1	510	36,532	524,4	6292,8	26,22	19,45	0	0,00	days
Takoz	777	288	1065	329	3,24	1	510	157,549	194,4	2332,8	9,72	52,47	20	6,18	days
Topay Mkn. Montaj	1997	607	2604	329	7,91	1	510	64,435	315,6	3787,2	15,78	32,32	1	0,13	days

Table 3.14 The maximum daily capacities of raw materials

Referans	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	Daily Max. Capacity
21286008B	3852	5094	5382	5562	3654	6858	4392	2934	3636	3960	4248	4482	3150	3672	4644	4914	411,48
1023797	2568	3396	3588	3708	2436	4572	2928	1956	2424	2640	2832	2988	2100	2448	3096	3276	274,32
21130005	1710	2808	1818	3420	1854	3798	3042	1962	2574	2592	2736	2970	1764	1746	2916	2772	227,88
21286006B	837	2352	1344	2768	1568	2896	2560	1744	1904	2144	2144	2480	1456	1488	2384	2320	173,76
21431188	1140	1872	1212	2280	1236	2532	2028	1308	1716	1728	1824	1980	1176	1164	1944	1848	151,92
21253106	1140	1872	1212	2280	1236	2532	2028	1308	1716	1728	1824	1980	1176	1164	1944	1848	151,92
3736481	1284	1698	1794	1854	1218	2286	1464	978	1212	1320	1416	1494	1050	1224	1548	1638	137,16
51257242	837	1176	672	1384	784	1448	1280	872	952	1072	1072	1240	728	744	1192	1160	86,88
21285208	665	1092	707	1330	721	1477	1183	763	1001	1008	1064	1155	686	679	1134	1078	88,62
21222306	570	936	606	1140	618	1266	1014	654	858	864	912	990	588	582	972	924	75,96
3735605	570	936	606	1140	618	1266	1014	654	858	864	912	990	588	582	972	924	75,96
3735615	570	936	606	1140	618	1266	1014	654	858	864	912	990	588	582	972	924	75,96
3735543	642	849	897	927	609	1143	732	489	606	660	708	747	525	612	774	819	68,58
1023804	588	879	810	978	624	1050	735	477	720	672	720	738	477	633	870	729	63
21253112	588	879	810	978	624	1050	735	477	720	672	720	738	477	633	870	729	63
3736435	588	879	810	978	624	1050	735	477	720	672	720	738	477	633	870	729	63
21431219	475	780	505	950	515	1055	845	545	715	720	760	825	490	485	810	770	63,3
21253108	475	780	505	950	515	1055	845	545	715	720	760	825	490	485	810	770	63,3
3728290	480	792	484	912	504	980	808	484	712	668	720	756	440	500	804	704	58,8
51256305 T0	410	520	220	410	500	275	430	495	490	425	340	410	215	385	1050	600	63
3930818	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	37,98
3930816	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	37,98
21528220	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	37,98
21431221	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	37,98
3730700	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	37,98
21528188	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	37,98
21431195	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	37,98
51000501	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	37,98
3930012	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	37,98
21285206	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	37,98
3735611	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	37,98
21286006B	240	396	242	456	252	490	404	242	356	334	360	378	220	250	402	352	29,4
21362095	210	348	232	434	228	484	400	240	306	298	358	362	226	210	344	322	29,04
21380125	246	342	342	270	120	432	180	96	192	198	168	216	138	216	132	396	25,92
3730875	190	312	202	380	206	422	338	218	286	288	304	330	196	194	324	308	25,32
3735610	190	312	202	380	206	422	338	218	286	288	304	330	196	194	324	308	25,32
3735609	190	312	202	380	206	422	338	218	286	288	304	330	196	194	324	308	25,32
21431158	190	312	202	380	206	422	338	218	286	288	304	330	196	194	324	308	25,32
21253105	190	312	202	380	206	422	338	218	286	288	304	330	196	194	324	308	25,32
21286006B	36	162	252	306	54	540	162	0	414	108	324	180	108	72	234	144	32,4
51257681	164	208	88	164	200	110	172	198	196	170	136	164	86	154	420	240	25,2
21431190	222	222	246	72	66	312	96	66	18	108	24	102	72	150	30	324	19,44
3735508	222	222	246	72	66	312	96	66	18	108	24	102	72	150	30	324	19,44
3729274	222	222	246	72	66	312	96	66	18	108	24	102	72	150	30	324	19,44
21431224	24	108	168	204	36	360	108	0	276	72	216	120	72	48	156	96	21,6
21431187	24	108	168	204	36	360	108	0	276	72	216	120	72	48	156	96	21,6
1023793	24	108	168	204	36	360	108	0	276	72	216	120	72	48	156	96	21,6
3735627	120	198	121	228	126	245	202	121	178	167	180	189	110	125	201	176	14,7
51000504	120	198	121	228	126	245	202	121	178	167	180	189	110	125	201	176	14,7

Table 3.15 The raw materials work in process quantities, screws and rivets are included

Reference	6.Station Quantity	7.Station Quantity	2 Boxes	Total Quantity	Daily Capacity	Daily WIP For Current Situation
59904	20	0	2	40	14,52	2,75
886597	0	1000	2	2000	3,24	617,28
1023790	0	1250	2	2500	94,68	26,40
1023792	0	500	2	1000	6,48	154,32
1023793	0	2000+2000	2	4000	21,6	185,19
1023797	0	2000+2000	2	4000	274,32	14,58
1023804	200	1000	2	2000	63	31,75
1781757	0	50	2	100	12,6	7,94
1796860	250	0	2	500	12,66	39,49
1946501	0	12	2	24	157,32	0,15
3723674	0	21	2	42	9,72	4,32
3727187	100	0	2	200	12,66	15,80
3727348	50	0	2	100	12,96	7,72
3727437	50	0	2	100	9,72	10,29
3727438	60	0	2	120	12,96	9,26
3727441	0	500	2	1000	9,72	102,88
3727782	0	75	2	150	9,72	15,43
3727786	0	24	2	48	78,66	0,61
3727789	0	30	2	60	78,66	0,76
3727934	40	0	2	80	12,96	6,17
3728209	0	30	2	60	47,34	1,27
3728290	250	0	2	500	58,8	8,50
3728711	0	200	2	400	9,72	41,15
3728785	10	0	2	20	13,56	1,47
3729274	0	400	2	800	19,44	41,15
3729342	0	15	2	30	78,66	0,38
3729866	0	30	2	60	15,78	3,80
3729868	0	15	2	30	3,24	9,26
3730677	10	0	2	20	12,66	1,58
3730678	7	0	2	14	12,66	1,11
3730679	50	0	2	100	12,66	7,90
3730700	0	100	2	200	37,98	5,27
3730747	0	30	2	60	12,66	4,74
3730875	0	20	2	40	25,32	1,58
3731133	0	15	2	30	3,24	9,26
3735451	100	0	2	200	12,96	15,43
3735504	20	0	2	40	9,72	4,12
3735508	10	0	2	20	19,44	1,03
3735524	0	15	2	30	15,78	1,90
3735530	0	20	2	40	3,24	12,35
3735531	0	9	2	18	3,24	5,56
3735532	0	20	2	40	3,24	12,35
3735533	0	15	2	30	3,24	9,26
3735536	0	50	2	100	3,24	30,86
3735537	0	300	2	600	3,24	185,19
3735543	25	0	2	50	68,58	0,73
3735566	0	200	2	400	3,24	123,46
3735568	0	30	2	60	3,24	18,52
3735574	0	30	2	60	78,66	0,76
3735574	0	20	2	40	78,66	0,51
3735583	0	30	2	60	15,78	3,80
3735602	0	50	2	100	12,66	7,90
3735603	0	50	2	100	78,66	1,27
3735605	0	75	2	150	75,96	1,97
3735606	0	20	2	40	12,66	3,16
3735607	0	20	2	40	12,66	3,16
3735608	0	10	2	20	12,66	1,58
3735609	0	30	2	60	25,32	2,37
3735610	0	75	2	150	25,32	5,92
3735611	0	100	2	200	37,98	5,27
3735612	0	100	2	200	12,66	15,80
3735615	0	50	2	100	75,96	1,32
3735617	0	30	2	60	12,66	4,74
3735627	50	0	2	100	14,7	6,80
3735638	0	30	2	60	3,24	18,52
3735784	0	20	2	40	15,78	2,53
3735804	0	50	2	100	9,72	10,29
3736435	24	0	2	48	63	0,76
3736481	100	0	2	200	137,16	1,46
3736510	0	30	2	60	157,32	0,38
3736521	0	30	2	60	157,32	0,38
3736687	0	0	2	0	26,22	0,00
3930012	0	250	2	500	37,98	13,16
3930816	0	20	2	40	37,98	1,05
3930818	0	50	2	100	37,98	2,63
21130005	1000	250	2	2000	227,88	8,78
21130006	0	2000	2	4000	14,4	277,78
21167122	0	500+500	2	1000	15,78	63,37
21167162	0	500+500	2	1000	12,66	78,99
21167222	0	500+500	2	1000	12,66	78,99

Reference	6.Station Quantity	7.Station Quantity	2 Boxes	Total Quantity	Daily Capacity	Daily WIP For Current Situation
21217108	0	100	2	200	3,24	61,73
21222004	0	200+200	2	400	189,36	2,11
21222306	0	1000	2	2000	75,96	26,33
21222308	0	250	2	500	3,24	154,32
21234205	0	?	2		6,48	
21253105	2000	2500	2	5000	25,32	197,47
21253106	0	2500+2500	2	5000	151,92	32,91
21253108	0	1200+1200	2	24000	63,3	379,15
21253110	0	500+500	2	1000	9,72	102,88
21253112	0	200	2	400	63	6,35
21253206	0	200	2	400	3,24	123,46
21285204	250	1000	2	2000	9,72	205,76
21285206	0	200	2	400	37,98	10,53
21285208	0	100	2	200	88,62	2,26
21362095	0	200	2	400	29,04	13,77
21380125	100	0	2	200	25,92	7,72
21431130	0	500	2	1000	94,68	10,56
21431158	0	200	2	400	25,32	15,80
21431187	200	0	2	400	21,6	18,52
21431188	200	1000+1000	2	2000	151,92	13,16
21431192	0	500	2	1000	9,72	102,88
21431195	0	200	2	400	37,98	10,53
21431218	0	200	2	400	78,66	5,09
21431219	0	200	2	400	63,3	6,32
21431221	0	200	2	400	37,98	10,53
21431224	200	0	2	400	21,6	18,52
21431250	0	200	2	400	157,32	2,54
21431251	0	200	2	400	78,66	5,09
21431252	0	100	2	200	9,72	20,58
21431252	0	100	2	200	9,72	20,58
21431254	0	100	2	200	47,34	4,22
21431281	0	100	2	200	314,64	0,64
21528188	0	500	2	1000	37,98	26,33
21528220	0	200	2	400	37,98	10,53
21528251	0	200	2	400	47,34	8,45
51000501	0	300	2	600	37,98	15,80
51000504	10	0	2	20	14,7	1,36
51000596	12	0	2	24	5,4	4,44
51000689	0	5	2	10	52,44	0,19
51000704	0	5	2	10	26,22	0,38
51000727	0	5	2	10	26,22	0,38
51000738	10	0	2	20	13,56	1,47
51000782	0	0	2	0	26,22	
51000821	0	0	2	0	26,22	
51000939	0	50	2	100	3,24	30,86
51257117	0	24	2	48	26,22	1,83
51257237	0	25	2	50	26,22	1,91
51257242	0	0	2	0	86,88	
51257275	0	0	2	0	1,74	
51257276	0	0	2	0	3,48	
51257277	0	0	2	0	5,22	
51257278	0	0	2	0	1,74	
51257279	0	0	2	0	3,48	
51257280	0	0	2	0	1,74	
51257282	0	0	2	0	1,8	
51257681	0	0	2	0	25,2	
51257682	0	0	2	0	12,6	
51257683	0	0	2	0	12,6	
51257703	0	0	2	0	12,66	
51257950	50	0	2	100	14,52	6,89
56920119	0	200	2	400	6,48	61,73
512577702	0	0	2	0	12,66	0,00
21286006B	0	200	2	400	173,76	2,30
21286008B	0	250+250	2	500	411,48	1,22
51238619FO	0	100	2	200	6,48	30,86
51256305 T0	0	5	2	10	63	0,16
51257952A	0	15+15	2	30	78,66	0,38
1040201	0	50	2	100		
3727565	50	0	2	100		
3735623	0	50	2	100		
3735565	0	50	2	100		
3735614	0	50	2	100		
3735621	20	0	2	40		
853059	0	500	2	1000		
56900401	0	250	2	500		
51000966	50	0	2	100		
1250 Kelepçe	0	0	2	0		
211300006	0	0	2	0		
TOTAL WIP				**90716**		**4237,454138**
AVERAGE WIP						**32,10**

Table 3.16 The raw materials work in process quantities, screws and rivets are not included

Referenc	6.Station Quantity	7.Station Quantity	2 Boxes	Total Quantity	Daily Capacity	Daily WIP For Current Situatio
59904	20		2	40	14,52	2,75
1781757		50	2	100	12,6	7,94
1946501		12	2	24	157,32	0,15
3723674		21	2	42	9,72	4,32
3727348	50		2	100	12,96	7,72
3727437	50		2	100	9,72	10,29
3727438	60		2	120	12,96	9,26
3727782		75	2	150	9,72	15,43
3727786		24	2	48	78,66	0,61
3727789		30	2	60	78,66	0,76
3727934	40		2	80	12,96	6,17
3728209		30	2	60	47,34	1,27
3728290	250		2	500	58,8	8,50
3728711		200	2	400	9,72	41,15
3728785	10		2	20	13,56	1,47
3729342		15	2	30	78,66	0,38
3729866		30	2	60	15,78	3,80
3729868		25	2	50	3,24	15,43
3730677	10		2	20	12,66	1,58
3730678	7		2	14	12,66	1,11
3730679	50		2	100	12,66	7,90
3730700		100	2	200	37,98	5,27
3730747		30	2	60	12,66	4,74
3730875		20	2	40	25,32	1,58
3731133		15	2	30	3,24	9,26
3735451	100		2	200	12,96	15,43
3735504	20		2	40	9,72	4,12
3735508	10		2	20	19,44	1,03
3735524		15	2	30	15,78	1,90
3735530		20	2	40	3,24	12,35
3735531		9	2	18	3,24	5,56
3735532		20	2	40	3,24	12,35
3735533		15	2	30	3,24	9,26
3735543	25		2	50	68,58	0,73
3735568		30	2	60	3,24	18,52
3735574		30	2	60	78,66	0,76
3735574		20	2	40	78,66	0,51
3735583		30	2	60	15,78	3,80
3735605		75	2	150	75,96	1,97
3735606		20	2	40	12,66	3,16
3735607		20	2	40	12,66	3,16
3735608		10	2	20	12,66	1,58
3735609		30	2	60	25,32	2,37
3735610		75	2	150	25,32	5,92
3735611		100	2	200	37,98	5,27
3735615		50	2	100	75,96	1,32
3735617		30	2	60	12,66	4,74
3735638		30	2	60	3,24	18,52
3735784		20	2	40	15,78	2,53
3735804		50	2	100	9,72	10,29
3736435	24		2	48	63	0,76
3736481	100		2	200	137,16	1,46
3930816		20	2	40	37,98	1,05
3930818		50	2	100	37,98	2,63
51000596	12		2	24	5,4	4,44
51000738	10		2	20	13,56	1,47
51000939		50	2	100	3,24	30,86
51257242			2	0	86,88	
51257950	50		2	100	14,52	6,89
512577702			2	0	12,66	
51256305 T0		5	2	10	63	0,16
1040201		50	2	100		
3727565	50		2	100		
3735623		50	2	100		
3735614		50	2	100		
3735621	20		2	40		
51000966	50		2	100		
TOTAL WIP				**5338**		**365,72**
AVERAGE WIP				**79,672**		**6,20**

The last document of the data collection was the layout of the current design. The team changed the design of the processes after the project diagnosis. They need the layouts of the workstations to analyse working conditions.

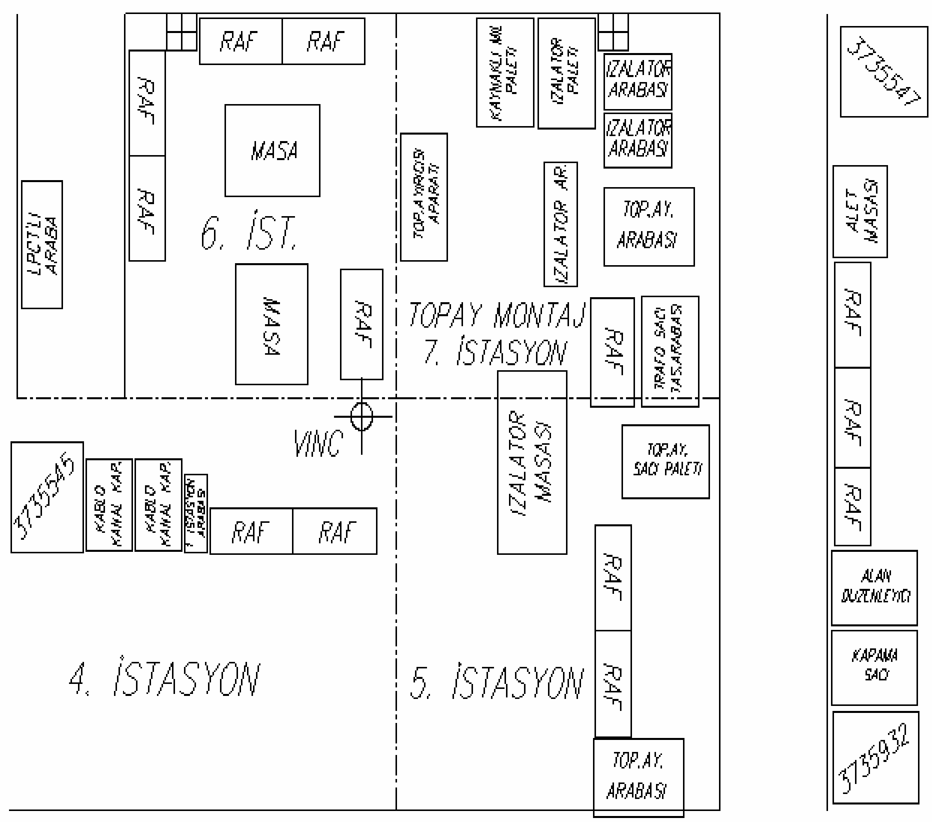


Figure 3.6 The layout of the current design

Before starting the project the project manager should inform the team members about the project time and flow. Because the team members should not expect to get their normal jobs done during a Kaizen Blitz. The kaizen activity is a full-time job, often lasting late into the night in order to implement the changes in three days. This team should include operators and any other relevant support staffs (maintenance, methods engineering, logistics, quality, etc.). The project manager informed the team members and their managers about the duration of the project. Our team members were organized as below.

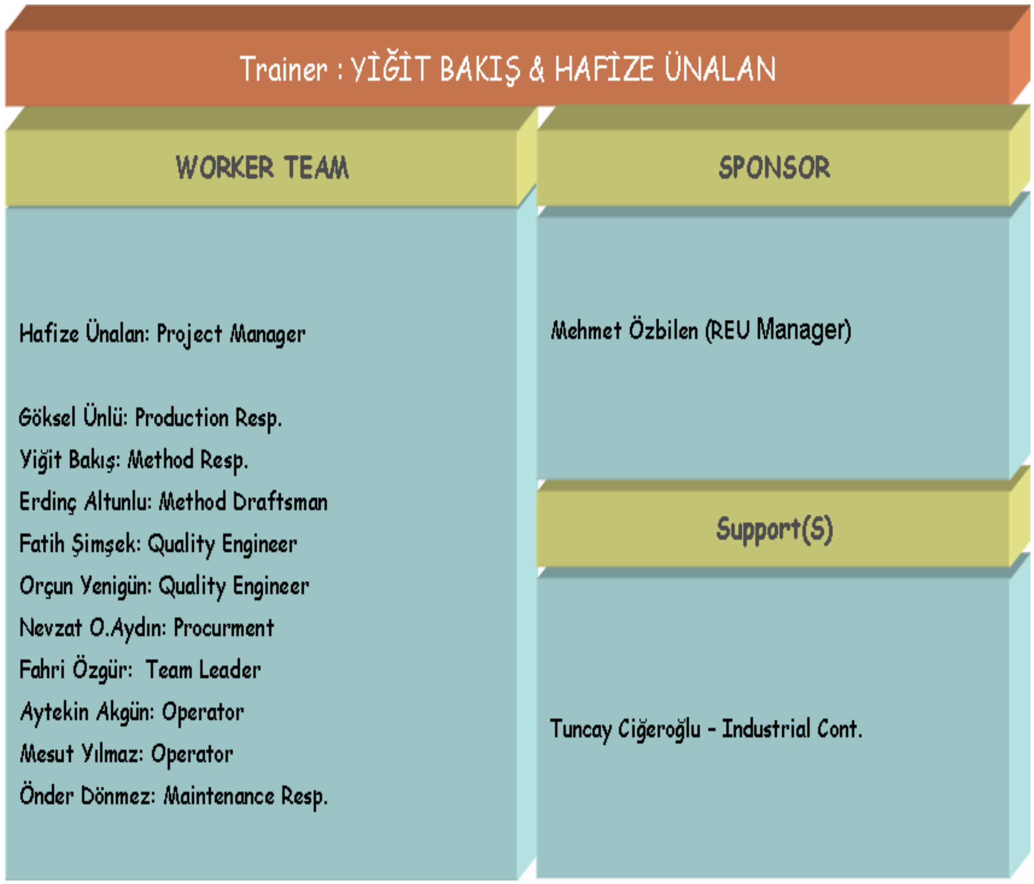
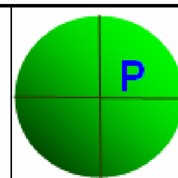


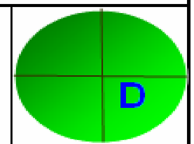
Figure 3.7 The team members

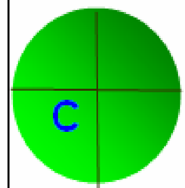
3.2.2.2 Agenda of Kaizen Blitz Project

We finished collecting necessary data and all necassary equipments. After that the Kaizen Blitz project started. Our Kaizen Event was an improvement project which was conducted in three days. The team had to use the time in an efficient way. To finish the project on time, we had to have a schedule. If anything went different from the schedule and the team deviated from the time goal, the improvements could not be achieved. We could see the event details and how the project went in three days at the agenda of the event. The Agenda of this three days event is below. The project manager had to pay attention to progress on time on the project and to direct the team on this way.

Table 3.17 Agenda of kaizen blitz project

Agenda 3-day KAIZEN event		
Day 1	**Objectives:** **Take the project into account** **Diagnosis and analyze the current situation**	
8:00 - 8:30	**Event release by plant management** - Objectives - Stakes - Rules - Presentation of project sheet	Plant manager
8:30 - 8:45	Presentation of Kaizen methodology	Project manager
8:45 - 9:00	Organization of the two days	Project manager
9:00 - 9:45	Presentation of Assembly Movie	Process manager
9:45 - 10:30	**Metaplan - 2 questions** about current dysfunctions	Project manager
10:30 - 10:45	*Break*	
10:45 - 11:00	Presentation of tools for current situation analysis	Project manager
11:00 - 12:00	**Analyze current data** - Qty - KE / KD - WIP Stocks - Surface analysis. Manufacturing / Storage etc. - WIP Stocks - Cmax, Takttime - BOMs, FMR analysis - Layouts - VSM	Project manager
12:00 - 13:00	*Lunch*	
13:00 - 15:30	**Work in sub-group on the current assembly process** - Assembly Flowchart for the stations 6 and 7	1st S- group
13:00 - 15:30	**Work in sub-group on the current assembly process** - Material Replenishment for the stations 6 and 7	2nd S- group
15:30 - 15:45	*Pause*	
15:45 - 17:00	**Work in group on the current assembly process** - Restitution from S-groups - People flow - Analysis of Components	Group
17:00 - 17:30	**Debriefing**	Group + Top Management

Agenda 3-day KAIZEN event Example		
Day 2	**Objectives:** **Define:** **- new process** **- management tools** **- Implement the new process**	
8:00 - 8:45	**Presentation of SPS principles to apply MPH and SIM**	Project manager
8:45 - 10:00	**Work in S-group** **Creation of a new assembly process** - Design the new flowchart for 6 and 7 Sub Assy.	1st S- group
8:45 - 10:00	**Work in S-group** **Creation of a new MPH process** - Design the new flowchart for Warehouse, 6 and 7 subassembly	2nd S- group
10:00 - 10:15	*Break*	
10:15 - 12:00	**Work in S-group** **Creation of a new working area** - Design the workstation - Design the new layout	1st S- group
10:15 - 12:00	**Work in S-group** **To implement MPH** - Physical flow, information flow - Warehouse organization - Deliverables for implementation	2nd S- group
12:00 - 13:00	*Lunch*	
13:00 - 13:30	**Full group** **Work presentation and exchanges between the S-groups**	group
13:30 - 15:00	**Work in S-group** **To implement SIM** - Validate indicators - Create a dashboard (posting) - management schedule	1st S- group
13:30 - 15:00	**Work in S-group** **To implement SIM** - Validate indicators - Create a dashboard (posting) - management schedule	2nd S- group
15:00 - 15:15	*Break*	
15:15 - 16:00	**Full Group** - Synthesis of works	group
16:00 - 17:00	**Full Group** - Work presentation before implementation . to operators . to Methods & Maintenance people . To the Plant management	group
17:00 - 17:30	*Pause*	
Day 2 evening	***Objective*** ***Implement the new layout*** ***and the 3 "S" Sort, Straightent, Shine***	
17:30 - 21:00	**Work in the plant** - Moving equipments and cleaning - Implement the new process and the new organization	Group Supprt functions. Auditors.
21:00 - 22:00	*Dinner*	

Agenda 3-day KAIZEN event Example		
Day 3	**Objectives:** **Re-start the process** **Setting of layout, storage and part replenishment** **Run short term actions** **Implement SIM**	
8:30 - 10:00	**Work in the plant** - Validate the new process - Start the new process - Set the new layout - Organize storage - Organize MPH - Implement indicators	team managers, logistical manager, group operators
10:00 - 10:30	**SIM meeting** - Define action plans for 1 day, 1 week,1 month	team managers, logistical manager, group operators
8:30 - 16:00	**Run Production**	
16:00 - 16:30	**End results of the 1st day** Difficulties - on processes - on MPH - on SIM corrective actions implemented - Point on action plans	team managers, logistical manager, group operators

3.2.2.2.1 Day 1. The first day of the Kaizen Blitz project was the day of explaining the project and the goals of the project and analysing the current situation. The event was launched by the plant manager, the team members should feel the top management support on the project. Kaizen Project can not be successful without strong support and direction from the top management. The plant manager explained his expectations from the project and put a target to the project. After that the project manager made a presentation about Kaizen methodology and explained what is Kaizen and Kaizen Blitz to the team. In the presentation he gave the definition of Kaizen and Kaizen Blitz. He explained why they made this Kaizen Project, what are the tools for this Project, how they can do the Project and what are the types of wastes. The team involved operators, because of this the project manager should explain everything simply and easily understood. He displayed the Agenda of the event and explained how is the event organised and how will the project go. Before the project started, the team watched the movies of the subassembly operations, there were support function members in the team who did not know the assembly process very well. If all of the team members did not know the process well, they could not find the wastes and improvement needs.

After the statement of the project and the process, the team started to analyse current situation. Identification of the current state was crucial first step in process improvement. The team needed a deep understanding of the existing processes. The project manager asked questions to the team and wanted them to write their answers on the post-its. First question was "What are the causes of waste and current non-performance?" After this question the team members wrote their thought about current dysfunctions on post-its. The types of wastes were explained before, to the team at the presentation. When they finished writing the causes of wastes, the project manager collected the post-its and posted them on the wall. After that the team grouped the causes, for our Kaizen Blitz project the main groups were:

- Part quality problems
- Process and Method problems
- MPH problems
- Workstation ergonomics and design
- WIP
- Assembly equipments
- Product

Figure 3.8 The causes of wastes and current dysfunctions

The team displayed the wastes of the processes. Now they should discuss about improvement ideas to solve these problems. The second question was “What are the solutions to improve performance and reach the goals?” They progressed in the same way. They wrote their ideas on post-its and the project manager collected these post-its when they finished writing. He posted the post-its on the wall and the team grouped the improvement ideas. The groups were:

- Improve Workstations & Ergonomics
- Improve MPH
- Improve Equipment
- Improve Process

Figure 3.9 The improvement ideas

The statement of improvement ideas finished and they had a break. After the break they continued detailed analysis of the current situation. They started to analyse the data for the current situation which was collected before the project by the project manager. The data which they analysed are below:

- Product Family
- Historical Production Quantities
- BOM of the subassembly products
- Time Measurements and efficiency coefficients

- WIP Stocks
- Surface analysis (Manufacturing / Storage etc.)
- Cmax, Takttime
- FMR analysis
- Layouts
- VSM of the line

This data increased the participant's knowledge about the processes and the situation. The last step of current situation analysis was visual representation of the current flow. They used flowchart tool for this. They drawed the flow charts in two aspect, they analysed the production and the material providing flows seperately. To do this they divided in two groups and worked in subgroups. One group analysed the production flow, other one analysed the material replenishment flow.

Manufacturing processes are composed with five different steps. These steps are:

1. **Value added Operation:** Operations are the steps of the process adding value to the product according to the customer requirement. Examples:
   - Parts assembly
   - Milling
   - Thermal treatment

Non value added Operation: Operations required by the process without value added. Examples:

- Work order release
- Picking

2. **Normative Inspection:** Inspections carried out according to the product norms or according to the customer requirements.

   Non-Normative Inspection

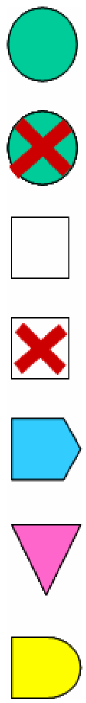
3. **Transportation:** It is the changes location of material or product.

4. **Storage:** Several kinds of storage are:

- Storage in a warehouse or another area.
- Storage on the line-side.
- Storage between operations: A full batch is waiting when the previous batch is assembled, inspected and transported.
- Storage because batch size: When assembling one piece, the other batch pieces are waiting.

5. **Waiting:** It is a short period (a few minutes) when a piece or a sub-assembly is waiting before the next operation on an automated equipment, without going out of the flow. A bad balance between operations, generate this waiting period.

Flow chart icons are below in Figure 3.10.



Value added OPERATION

Non value added OPERATION

NORMATIVE INSPECTION

Non-NORMATIVE INSPECTION

TRANSPORTATION

STORAGE

WAITING

Figure 3.10 The flow chart icons

The team drawed the flow charts with post-its on the wall. The flow charts of the process production flows are:

For 6.station:

Figure 3.11 The flow chart of 6.station

For 7.station:

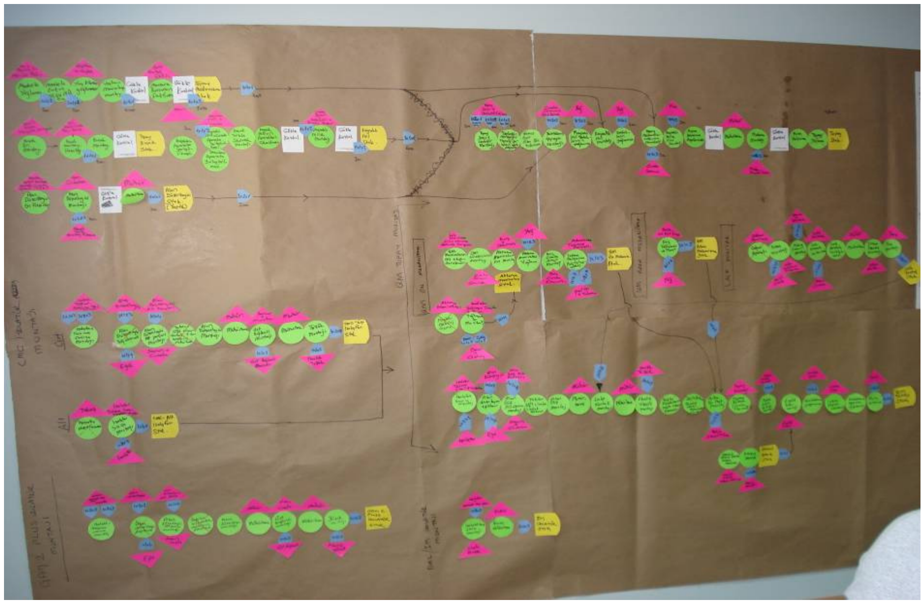


Figure 3.12 The flow chart of 7.station

They calculated from flowcharts the walking distance, they looked how many meters should an operator walk to make these subassemlies. For 6.station this was 168 m/day, for 7.station 354 m/day. The flow chart of the process material providing and handling is:

Figure 3.13 The flow chart of material providing and handling

First day finished with debriefings. The subgroups explained the flows to the other groups. And finally they made a presentation to the manager. First Kaizen Blitz Project date was the date of analysing deeply the current state and finding current wastes and solutions about the processes.

3.2.2.2.2 Day 2. The second day started with the presentations about the company production system, material providing and handling principles and short interval management. The company had a short interval management (SIM) system. This was a meetings loop and a system based on a high frequency relationship between the management and its employees. It concerned both Production and the Support Functions. It established the link between production process and support functions. The production leader and his team recorded the problem in a working day in production. Every morning all support function members (method, planning, procurment, purchasing and quality), the production responsible and the team leader came together in the production line, they talked about the problems and wastes of the passing day. They wrote the actions to solve the problems and the dates to finish the action. Every participant tried to accomplish his own action in due date. If he could not solve the action, he teold the problem to his manager at their SIM meeting (other loop of meetings) and they discussed about the solutions. If they could not find anything, the manager explained the problem to his manager, the meeting loop went like this. The meeting loop for short interval management is like in the Figure 3.14.

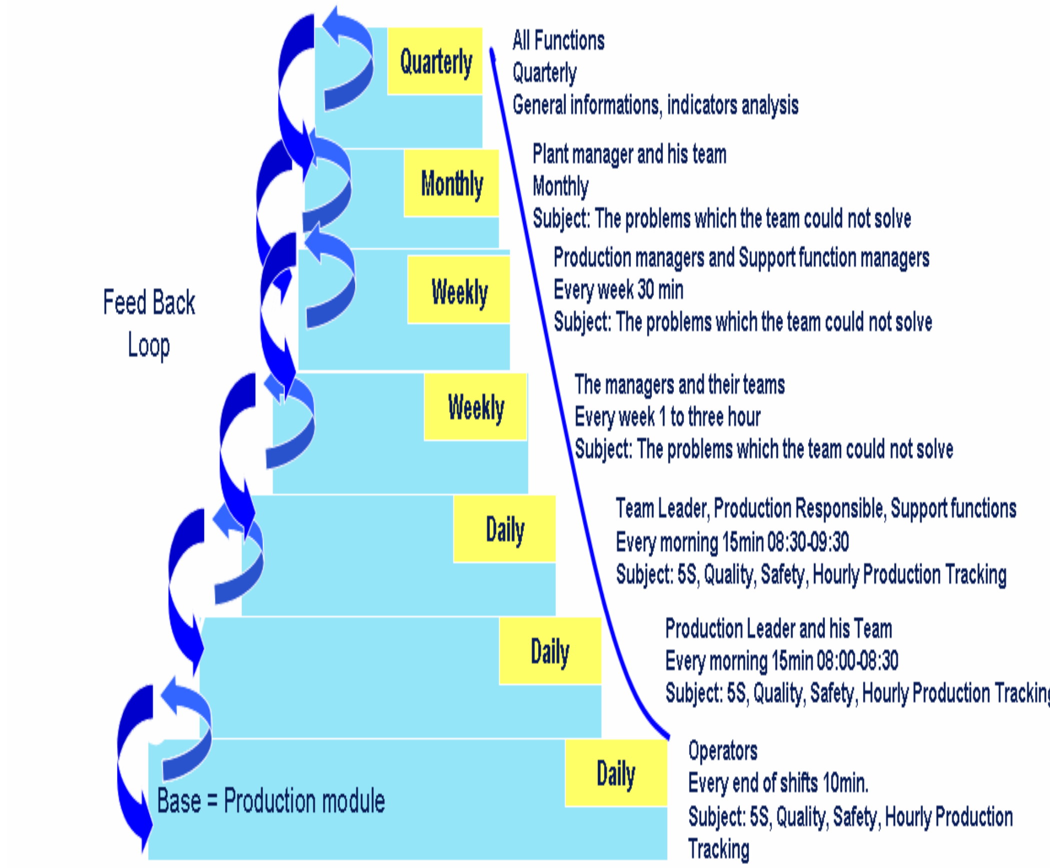


Figure 3.14 The meeting loop for short interval management

Material providing and handling system is the material flow from the supplier of compenents to the delivery of finished product. The aim of the system is to provide the right component in the right quantity and on time at each workstation and eliminate non value added in material flows like;

- Interruptions (like three steps reception process)
- Multiple handling and container transfers
- Searching parts in warehouse
- Repacking, recounting
- Oversized WIP

All parts have to be as close as possible from the operator point of use. The rules and the steps of the material providing and handling system are:

- Identification of all the components needed on the workstation.
- Checking consistency between container size and available area on the station (width, height).
- Definition of a minimum quantity of components to avoid supply shortage.
- Implementation a Kanban concept with two containers per component on workstation (full box, empty box).
- Delivering a new container before stock shortage.
- Taking the volume, quantity, weight into account.
- Application of rules of 5S.
- Application of ergonomic rules to operator and material handler.

After this explanation of the system, designing and implementing the new process started. The team used these useful informations to design the new processes and flow. They again worked in subgroups and drawed the new flowcharts for production and for material providing and handling flows. They removed as much as possible non value added times (reduce move, double recording, recounting, waiting) and reduced the flow length. (Segerstedt, 1999) To do this they looked at the current flows and decided non value added operations. After that they removed these non value added operations by writing a solution and an action to remove the operation. They progressed operation by operation and eliminated as much as possible non value added operations. Final state of the new flows are below.

For 6.station

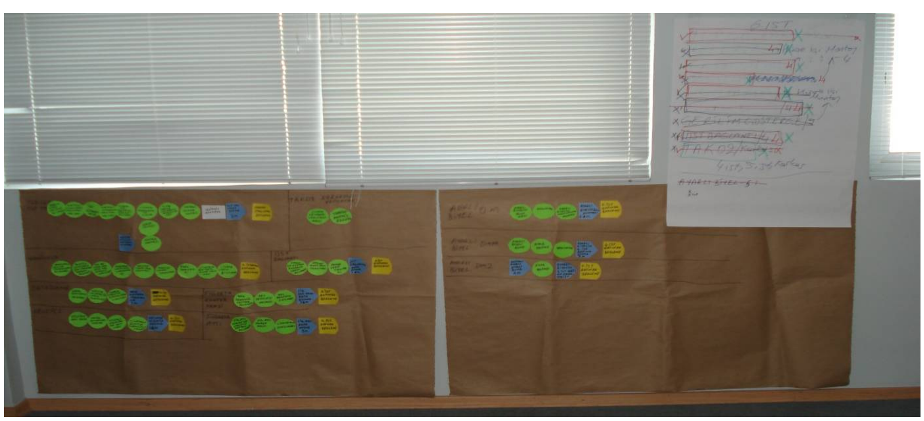


Figure 3.15 New flow chart of 6.station

For 7.station

Figure 3.16 New flow chart of 7.station

For Material providing and handling

Figure 3.17 New flow chart of material providing and handling

After the design of new flow, they continued working in sub groups. All analysis finished, they had information about the process, the flow, the wastes, the problems and the solutions. Every team members had improvement ideas. They could start the design and implementation step. One group focused on improvement ideas about the processes designs and changes layout. They would decide the new design of the workstations. Other group focused on the material flow improvements for workstations and for warehouse. The subgroups designed their new layouts. After they finished the designs, they showed their layouts and explained the improvement ideas. Finally full group had to decide one best layout option. They decided the below layout to apply, this layout was selected from three alternatives.

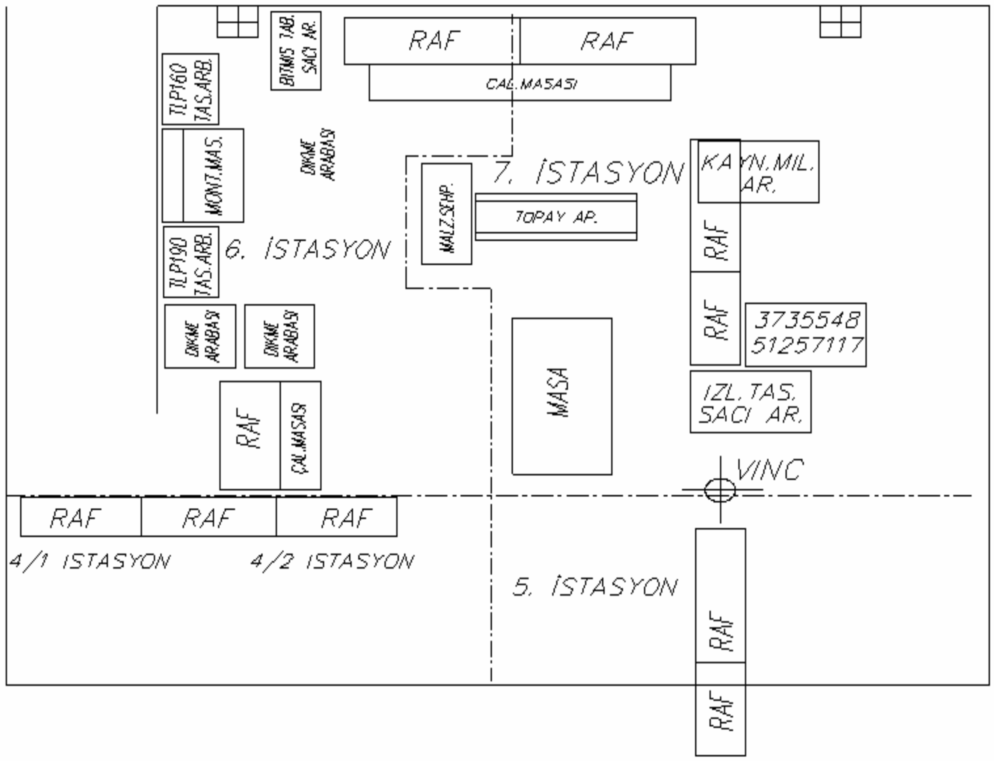


Figure 3.18 New layout of the stations

Most tiring steps came, the team should apply the new layout on the production area. The team not only planned, they cleaned equipments, sort tools, moved machinery, assembled, built, and run the process. They built the new workstations according to the layout. They did everything with what they had already in hand. They changed some fixtures, aparatas and shelves with welding and cutting. All jobs finished at the late of the night.

3.2.2.2.3 Day 3. After finishing the new design they did their first short interval management meeting at the new production area. With SIM implementation production tracking was implemented by the operators hourly. And also quality indicator manufacturing defect rate was tracked as a key indicator for the production. They accomplished the short term actions, but they wrote some long term actions and made an action plan. The action plan of the event is in table 3.18.

Table 3.18 The action plan of the kaizen blitz project

	Actions	Responsible
1	Improving Earthing Switch Assembly Tool	Method
2	Designing cats for Isolator, Isolator sheet, welded mil, floor sheet metal	Method
3	Providing needed tools and air fixtures for every workbenches	Method and Maintenance
4	Improving box quantities	Production
5	Designing missing tools	Method
6	Starting two box system for the subassembly products, minimizing subassembly WIP.	Production
7	Making painted front cover cart smaller.	Method
8	Investigating to assembly middle fixing at different station	Method
9	Investigating the filing problem for the Alan düzenleyici	Quality
10	To widen isolator assembly shelf	Method and Maintenance
11	Revising 4/1, 4/2 stations cycle time	Method
12	Following KE	Production
13	Following all problems in SIM	Production
14	Following IFR, MDR for this stations	Production and quality
15	Providing coming crowbar in an appropriate box without a nylon package	Procurment
16	Localisation of adjusted rod	Purchasing
17	Making plaited copper in busbar	Production
18	Providing ergonomic chairs	Method

The production started with the new layout and all material providing handling activities were organised according to the new layout. The team decided the indicators to follow and followed these indicators to see the benefits and improvements with the new design. Finally they made a presentation to the management committee. They gave the details of the Kaizen Blitz Project and stated the results of the project.

3.2.2.3 The Results of the Kaizen Blitz Project

The Kaizen Blitz project resulted some obvious benefits to the company. We can summarise them as below.

3.2.2.3.1 Space Utilization Result. With Kaizen Blitz project the team changed the layout for the selected workstations and processes. They designed a new layout. We can see the old layout at figure 3.6 and the new one at Figure 3.18. The workbenches were designed in order to make the production and the material flow leaner. With these changes the working condition for operators was more ergonomic than before. Maximum utilisation of the operators and versatility was one of the goals. Workstations were designed to allow operators operate several stations, operators could assist neighboring stations.

Before the Kaizen Blitz Project total space of the layout was 65 m², after the project it was reduced to 49 m². There was % 24 saving of space utilisation. The team had some actions for long term, the project manager had also calculated the space after these actions completed. After the actions were complated, the tools improved and the size of the cars reduced the space area was 41 m² and the saving of space utillisation was 37%.

3.2.2.3.2 WIP Stocks Result. In table 3.14 and table 3.15 we calculated current WIP stocks on the workstations. It was for raw materials 32.10 days WIP, it is included screws and rivets, 6,2 days WIP, it is not included screws and rivets. While Kaizen Blitz project the project manager had calculated new quantities for boxes and the team changed all box quantities at the new design implementation according to this calculation. The box quantities were calculated as below formula.

$$\text{Quantity} = \frac{(\text{Cmax} * n)(2 * F)(1 + S)}{(N - 1)}$$

Consumption:	Cmax	(Capacity per hours)
Feeding Period:	F	(time between two material provider cycles)
Quantity / product :	n	(numbers of part required for one finished product)
boxes qty :	N	(2 boxes per part reference)
Safety rate:	S	(rate to avoid part shortage, we took S = 10%)

After the calculation of box quantities the project manager made some assumptions about results, he investigated the material, the material package, the supplier package quantity and the method of material providing. After that he decided new boxes quantities, they are in table 3.19.

Table 3.19 New box quantities

Reference	J-06	F-06	M-06	A-06	M-06	J-06	J-06	A-06	S-06	O-06	N-06	D-06	J-07	F-07	M-07	A-07	Hourly Cmax	F (Time between two cycles)	N (2 boxes per part reference)	S (rate to avoid part shortage)	Quantity for one box	6.Station Quantity	7.Station Quantity	New Quantity	NOTES
59904	105	174	116	217	114	242	200	120	153	149	179	181	113	105	172	161	1,708	120	2	0,1	8	20		20	Özel Paketinde 20 adet geliyor.
886597	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		1000	250	Kutusu 1000 Adet
1023790	792	1158	852	1212	684	1578	1110	720	876	972	936	1092	660	732	1002	1248	11,139	120	2	0,1	49		1250	250	250 şer adetlik yapılmalı Küçük Kutu
1023792	74	70	82	24	22	80	32	22	6	36	8	34	24	50	10	108	0,762	120	2	0,1	3		500	500	250 şer adetlik yapılmalı Küçük Kutu
1023793	24	108	168	204	36	360	108	0	276	72	216	120	72	48	156	96	2,541	120	2	0,1	11		2000+2000	2000	Kendi kutusunda 2000 adet var.
1023797	2568	3396	3588	3708	2436	4572	2928	1956	2424	2640	2832	2988	2100	2448	3096	3276	32,273	120	2	0,1	142		2000+2000	250	Kendi kutusunda 2000 adet var.
1023804	588	879	810	978	624	1050	735	477	720	672	720	738	477	633	870	729	7,412	120	2	0,1	33	200	1000	200	Adet 200 olarak 7.İstasyon da
1781757	14	63	98	119	21	210	63	0	161	42	126	70	42	28	91	56	1,482	120	2	0,1	7		50	35	4 adet kutu ilavesi gerekiyor. (2
1796860	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7	250		250	Kendi paketi 250 lik ve en küçük
1946501	1476	2106	2010	2190	1434	2622	1758	1098	1560	1542	1644	1716	1170	1476	1878	1878	18,508	120	2	0,1	81		12	12	Araba tasarlanıyor. 15 lik yapılacak
3723674	111	111	123	36	33	156	48	33	9	54	12	51	36	75	15	162	1,144	120	2	0,1	5		21	15	Orta boy kutuda
3727187	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7	100		100	Küçük kutuda
3727348	123	171	171	135	60	216	90	48	96	99	84	108	69	108	66	198	1,525	120	2	0,1	7	50		18	Orta boy kutuda kutu aynen kalacak
3727437	111	111	123	36	33	156	48	33	9	54	12	51	36	75	15	162	1,144	120	2	0,1	5	50		18	En küçük kutu kutu aynen kalacak
3727438	123	171	171	135	60	216	90	48	96	99	84	108	69	108	66	198	1,525	120	2	0,1	7	60		18	Küçük kutuda sadece adet 30 adete
3727441	111	111	123	36	33	156	48	33	9	54	12	51	36	75	15	162	1,144	120	2	0,1	5		500	250	Kendi poşeti 250 lik Küçük kutu
3727782	111	111	123	36	33	156	48	33	9	54	12	51	36	75	15	162	1,144	120	2	0,1	5		75	15	En küçük kutuda 15 adet olarak
3727786	738	1053	1005	1095	717	1311	879	549	780	771	822	858	585	738	939	939	9,254	120	2	0,1	41		24	24	Malzeme büyük ve adet yeterli.
3727789	738	1053	1005	1095	717	1311	879	549	780	771	822	858	585	738	939	939	9,254	120	2	0,1	41		30	24	Adet 24 adete düşürülecek. Kutu aynı
3727934	123	171	171	135	60	216	90	48	96	99	84	108	69	108	66	198	1,525	120	2	0,1	7	40		18	Adet 30 düşecek. Kutu ebatı
3728209	396	579	426	606	342	789	555	360	438	486	468	546	330	366	501	624	5,569	120	2	0,1	25		30	30	Adet 24 de düşecek. Kutu aynısı
3728290	480	792	484	912	504	980	808	484	712	668	720	756	440	500	804	704	6,918	120	2	0,1	30	250		50	Adetler 100 e düşürülecek. En küçük
3728711	111	111	123	36	33	156	48	33	9	54	12	51	36	75	15	162	1,144	120	2	0,1	5		200	20	Adetler 50 ye düşürülecek. En küçük
3728785	98	178	107	208	107	226	184	115	158	148	157	171	97	109	173	165	1,595	120	2	0,1	7	10		10	Değişikliğe gerek yok.
3729274	222	222	246	72	66	312	96	66	18	108	24	102	72	150	30	324	2,287	120	2	0,1	10		400	100	Mevcut en küçük kutu. Adet 100
3729342	738	1053	1005	1095	717	1311	879	549	780	771	822	858	585	738	939	939	9,254	120	2	0,1	41		15	15	Değişikliğe gerek yok.
3729866	132	193	142	202	114	263	185	120	146	162	156	182	110	122	167	208	1,856	120	2	0,1	8		30	15	En küçük kutu gerekir. Kutudaki adet
3729868	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		15	25	Değişikliğe gerek yok.
3730677	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7	10		10	Aynı kutu adet 7 olarak azaltılacak
3730678	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7	7		7	
3730679	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7	50		10	En küçük gerekiyor. Adet 7 ye
3730700	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	4,468	120	2	0,1	20		100	25	En küçük kutu gerekir. Kutuda 60
3730747	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7		30	20	Dikey hazırlana bara borusu sadece
3730875	190	312	202	380	206	422	338	218	286	288	304	330	196	194	324	308	2,979	120	2	0,1	13		20	20	Değişikliğe gerek yok.
3731133	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		15	15	Değişikliğe gerek yok.
3735451	123	171	171	135	60	216	90	48	96	99	84	108	69	108	66	198	1,525	120	2	0,1	7	100		18	Kendi kutusu 100 lük değiştirilemez.
3735504	111	111	123	36	33	156	48	33	9	54	12	51	36	75	15	162	1,144	120	2	0,1	5	20		18	Değişikliğe gerek yok.
3735508	222	222	246	72	66	312	96	66	18	108	24	102	72	150	30	324	2,287	120	2	0,1	10	10		10	Karkasa gönderildi.
3735524	132	193	142	202	114	263	185	120	146	162	156	182	110	122	167	208	1,856	120	2	0,1	8		15	15	Kendi ambalajı 15 li olduğundan

Reference	J-06	F-06	M-06	A-06	M-06	J-06	J-06	A-06	S-06	O-06	N-06	D-06	J-07	F-07	M-07	A-07	Hourly Cmax	F (Time between two cycles)	N (2 boxes per part reference)	S (rate to avoid part shortage)	Quantity for one box	6.Station Quantity	7.Station Quantity	New Quantity	NOTES
3735530	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		20	10	Kutu ebatı değişmeyecek. Kutudaki
3735531	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		9	9	Kendi kutusu olduğundan
3735532	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		20	20	Kutu ebatı değişmeyecek. Kutudaki
3735533	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		15	15	Değişikliğe gerek yok.
3735536	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		50	30	Kutu ebatı değişmeyecek. Kutudaki
3735537	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		300	100	Küçük kutu gerekir. Kutudaki adet 20
3735543	642	849	897	927	609	1143	732	489	606	660	708	747	525	612	774	819	8,068	120	2	0,1	36	25		25	Değişikliğe gerek yok.
3735566	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		200	50	Küçük kutu gerekir. Kutudaki adet 20
3735568	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		30	20	Kutu ebatı değişmeyecek. Kutudaki
3735574	738	1053	1005	1095	717	1311	879	549	780	771	822	858	585	738	939	939	9,254	120	2	0,1	41		30	30	Değişikliğe gerek yok.
3735574	396	579	426	606	342	789	555	360	438	486	468	546	330	366	501	624	5,569	120	2	0,1	25		30	30	Değişikliğe gerek yok.
3735583	132	193	142	202	114	263	185	120	146	162	156	182	110	122	167	208	1,856	120	2	0,1	8		30	30	Değişikliğe gerek yok.
3735602	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7		50	50	Araba tasarlanıyor. 14 lük yapılacak
3735603	738	1053	1005	1095	717	1311	879	549	780	771	822	858	585	738	939	939	9,254	120	2	0,1	41		50	50	Araba yada seperatör tasarlanacak
3735605	570	936	606	1140	618	1266	1014	654	858	864	912	990	588	582	972	924	8,936	120	2	0,1	39		75	75	Kutu değişmeyecek. Adet 60 olarak
3735606	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7		20	20	Değişikliğe gerek yok.
3735607	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7		20	20	Değişikliğe gerek yok.
3735608	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7		10	10	Değişikliğe gerek yok.
3735609	190	312	202	380	206	422	338	218	286	288	304	330	196	194	324	308	2,979	120	2	0,1	13		30	15	Kutu ebatı değişmeyecek. Adet 20
3735610	190	312	202	380	206	422	338	218	286	288	304	330	196	194	324	308	2,979	120	2	0,1	13		75	20	Kutu ebatı değişmeyecek. Adet 20
3735611	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	4,468	120	2	0,1	20		100	30	Kutu ebatı değişmeyecek. Adet 60
3735612	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7		100	100	Kutu ebatı değişmeyecek. Adet 60
3735615	570	936	606	1140	618	1266	1014	654	858	864	912	990	588	582	972	924	8,936	120	2	0,1	39		50	50	Değişikliğe gerek yok.
3735617	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7		30	15	Küçük kutu gereki Adet 15 olarak
3735627	120	198	121	228	126	245	202	121	178	167	180	189	110	125	201	176	1,729	120	2	0,1	8	50		50	KIT Arabası Adet 15 olarak yeni araba
3735638	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		30	20	Kutu ebatı en küçük kutu olacak.
3735784	132	193	142	202	114	263	185	120	146	162	156	182	110	122	167	208	1,856	120	2	0,1	8		20	20	Ambalaj adeti olduğundan
3735804	111	111	123	36	33	156	48	33	9	54	12	51	36	75	15	162	1,144	120	2	0,1	5		50	15	Kutu ebatı aynen kalacak Adet 30
3736435	588	879	810	978	624	1050	735	477	720	672	720	738	477	633	870	729	7,412	120	2	0,1	33	24		24	Değişikliğe gerek yok.
3736481	12	54	84	102	18	180	54	0	138	36	108	60	36	24	78	48	1,271	120	2	0,1	6	100		30	Değişikliğe gerek yok.
3736510	1476	2106	2010	2190	1434	2622	1758	1098	1560	1542	1644	1716	1170	1476	1878	1878	18,508	120	2	0,1	81		30	30	Değişikliğe gerek yok.
3736521	1476	2106	2010	2190	1434	2622	1758	1098	1560	1542	1644	1716	1170	1476	1878	1878	18,508	120	2	0,1	81		30	30	Değişikliğe gerek yok.
3736687	246	351	335	365	239	437	293	183	260	257	274	286	195	246	313	313	3,085	120	2	0,1	14			işe özel	İşe özel isteniyor. Adet yok.
3930012	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	4,468	120	2	0,1	20		250	100	Kutu ebatı küçülecek Adet:100 olacak
3930816	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	4,468	120	2	0,1	20		20	20	Değişikliğe gerek yok.
3930818	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	4,468	120	2	0,1	20		50	15	Kutu ebatı dğişmeyecek, Adet 20 ye

Reference	J-06	F-06	M-06	A-06	M-06	J-06	J-06	A-06	S-06	O-06	N-06	D-06	J-07	F-07	M-07	A-07	Hourly Cmax	F (Time between two cycles)	N (2 boxes per part reference)	S (rate to avoid part shortage)	Quantity for one box	6.Station Quantity	7.Station Quantity	New Quantity	NOTES
21130005	1710	2808	1818	3420	1854	3798	3042	1962	2574	2592	2736	2970	1764	1746	2916	2772	26,809	120	2	0,1	118	1000	250	250	Her iki istasyonda da perçin
21130006	1056	1544	1136	1616	912	2104	1480	960	1168	1296	1248	1456	880	976	1336	1664	14,852	120	2	0,1	65		2000	2000	Paketi 2000 adet olduğundan adet
21167122	132	193	142	202	114	263	185	120	146	162	156	182	110	122	167	208	1,856	120	2	0,1	8		500+500	250	Kutu ebatı küçük kutu olacak
21167162	132	193	142	202	114	263	185	120	146	162	156	182	110	122	167	208	1,856	120	2	0,1	8		500+500	250	Kutu ebatı küçük kutu olacak
21167222	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7		500+500	250	Kutu ebatı küçük kutu olacak
21217108	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		100	100	Kendi paketi 100 lük olduğundan
21222004	1584	2316	1704	2424	1368	3156	2220	1440	1752	1944	1872	2184	1320	1464	2004	2496	22,278	120	2	0,1	98		200+200	200	Kutu ebatları ufak ve kendi paketi
21222306	570	936	606	1140	618	1266	1014	654	858	864	912	990	588	582	972	924	8,936	120	2	0,1	39		1000	1000	Kutu ebatları ufak ve kendi paketi
21222308	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		250	250	Kutu ebatları ufak ve kendi paketi
21234205	1584	2316	1704	2424	1368	3156	2220	1440	1752	1944	1872	2184	1320	1464	2004	2496	22,278	120	2	0,1	98		?	0	
21253105	190	312	202	380	206	422	338	218	286	288	304	330	196	194	324	308	2,979	120	2	0,1	13	2000	2500	250	Her iki istasyon için en küçük kutu
21253106	1140	1872	1212	2280	1236	2532	2028	1308	1716	1728	1824	1980	1176	1164	1944	1848	17,873	120	2	0,1	79		2500+2500	200	İstasyonda iki ayrı noktada 200
21253108	475	780	505	950	515	1055	845	545	715	720	760	825	490	485	810	770	7,447	120	2	0,1	33		1200+1200	100	İstasyonda iki ayrı noktada 100
21253110	738	1053	1005	1095	717	1311	879	549	780	771	822	858	585	738	939	939	9,254	120	2	0,1	41		500+500	200	İstasyonda iki ayrı noktada 200
21253112	588	879	810	978	624	1050	735	477	720	672	720	738	477	633	870	729	7,412	120	2	0,1	33		200	100	Değişikliğe gerek yok.
21253206	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		200	200	Değişikliğe gerek yok.
21285204	792	1158	852	1212	684	1578	1110	720	876	972	936	1092	660	732	1002	1248	11,139	120	2	0,1	49	250	1000	200	Kutu ebatı küçülecek ve 200 adet
21285206	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	4,468	120	2	0,1	20		200	200	Değişikliğe gerek yok.
21285208	665	1092	707	1330	721	1477	1183	763	1001	1008	1064	1155	686	679	1134	1078	10,426	120	2	0,1	46		100	100	Değişikliğe gerek yok.
21362095	210	348	232	434	228	484	400	240	306	298	358	362	226	210	344	322	3,416	120	2	0,1	15		200	1000	Değişikliğe gerek yok.+İlave kutu
21380125	246	342	342	270	120	432	180	96	192	198	168	216	138	216	132	396	3,049	120	2	0,1	13	100		100	Değişikliğe gerek yok.+İlave kutu
21431130	792	1158	852	1212	684	1578	1110	720	876	972	936	1092	660	732	1002	1248	11,139	120	2	0,1	49		500	200	Kutu ebatı küçülecek ve 200 adet
21431158	190	312	202	380	206	422	338	218	286	288	304	330	196	194	324	308	2,979	120	2	0,1	13		200	200	Değişikliğe gerek yok.+İlave kutu
21431187	24	108	168	204	36	360	108	0	276	72	216	120	72	48	156	96	2,541	120	2	0,1	11	200		500	Değişikliğe gerek yok.
21431188	1140	1872	1212	2280	1236	2532	2028	1308	1716	1728	1824	1980	1176	1164	1944	1848	17,873	120	2	0,1	79	200	1000+1000	500	Küçük kutu olacak 7. İstasyon Adet
21431192	528	772	568	808	456	1052	740	480	584	648	624	728	440	488	668	832	7,426	120	2	0,1	33		500	200	Kutu ebatı küçülecek ve 200 adet
21431195	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	4,468	120	2	0,1	20		200	200	Değişikliğe gerek yok.
21431218	738	1053	1005	1095	717	1311	879	549	780	771	822	858	585	738	939	939	9,254	120	2	0,1	41		200	200	Değişikliğe gerek yok.
21431219	475	780	505	950	515	1055	845	545	715	720	760	825	490	485	810	770	7,447	120	2	0,1	33		200	200	Değişikliğe gerek yok.

Reference	J-06	F-06	M-06	A-06	M-06	J-06	J-06	A-06	S-06	O-06	N-06	D-06	J-07	F-07	M-07	A-07	Hourly Cmax	F (Time between two cycles)	N (2 boxes per part reference)	S (rate to avoid part shortage)	Quantity for one box	6.Station Quantity	7.Station Quantity	New Quantity	NOTES
21431221	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	4,468	120	2	0,1	20		200	200	Değişikliğe gerek yok.
21431224	24	108	168	204	36	360	108	0	276	72	216	120	72	48	156	96	2,541	120	2	0,1	11	200		200	Değişikliğe gerek yok.
21431250	1476	2106	2010	2190	1434	2622	1758	1098	1560	1542	1644	1716	1170	1476	1878	1878	18,508	120	2	0,1	81		200	200	Değişikliğe gerek yok.+Eksik kutu 1
21431251	738	1053	1005	1095	717	1311	879	549	780	771	822	858	585	738	939	939	9,254	120	2	0,1	41		200	200	Değişikliğe gerek yok.
21431252	111	111	123	36	33	156	48	33	9	54	12	51	36	75	15	162	1,144	120	2	0,1	5		100	100	Değişikliğe gerek yok.
21431252	738	1053	1005	1095	717	1311	879	549	780	771	822	858	585	738	939	939	9,254	120	2	0,1	41		100	100	Değişikliğe gerek yok.
21431254	396	579	426	606	342	789	555	360	438	486	468	546	330	366	501	624	5,569	120	2	0,1	25		100	100	Değişikliğe gerek yok.
21431281	2952	4212	4020	4380	2868	5244	3516	2196	3120	3084	3288	3432	2340	2952	3756	3756	37,016	120	2	0,1	163		100	100	Değişikliğe gerek yok.
21528188	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	4,468	120	2	0,1	20		500	250	Kutu ebatı küçülecek. Adet 200
21528220	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	4,468	120	2	0,1	20		200	200	Değişikliğe gerek yok.
21528251	396	579	426	606	342	789	555	360	438	486	468	546	330	366	501	624	5,569	120	2	0,1	25		200	200	Değişikliğe gerek yok.
51000501	285	468	303	570	309	633	507	327	429	432	456	495	294	291	486	462	4,468	120	2	0,1	20		300	300	Kutu ebatı küçülecek ve 100 adet
51000504	120	198	121	228	126	245	202	121	178	167	180	189	110	125	201	176	1,729	120	2	0,1	8	10		10	10 Adet alacak şekilde araba
51000596	6	27	42	51	9	90	27	0	69	18	54	30	18	12	39	24	0,635	120	2	0,1	3	12		12	Değişikliğe gerek yok.
51000689	492	702	670	730	478	874	586	366	520	514	548	572	390	492	626	626	6,169	120	2	0,1	27		5	5	Dikey koymak için 10 adetlik araba
51000704	246	351	335	365	239	437	293	183	260	257	274	286	195	246	313	313	3,085	120	2	0,1	14		5	5	10 adetlik seperatör yapılacak
51000727	246	351	335	365	239	437	293	183	260	257	274	286	195	246	313	313	3,085	120	2	0,1	14		5	5	10 adetlik seperatör yapılacak
51000738	98	178	107	208	107	226	184	115	158	148	157	171	97	109	173	165	1,595	120	2	0,1	7	10		10	Ebatına göre 10 adet alacak şekilde
51000782	246	351	335	365	239	437	293	183	260	257	274	286	195	246	313	313	3,085	120	2	0,1	14			0	İşe özel isteniyor. Adet yok.
51000821	246	351	335	365	239	437	293	183	260	257	274	286	195	246	313	313	3,085	120	2	0,1	14			0	İşe özel isteniyor. Adet yok.
51000939	37	35	41	12	11	40	16	11	3	18	4	17	12	25	5	54	0,381	120	2	0,1	2		50	25	Kutu ebatı değişmeyecek. Adet 20
51257117	246	351	335	365	239	437	293	183	260	257	274	286	195	246	313	313	3,085	120	2	0,1	14		24	24	12 adetlik araba yapılacak
51257237	246	351	335	365	239	437	293	183	260	257	274	286	195	246	313	313	3,085	120	2	0,1	14		25	25	12 adetlik araba yapılacak
51257242	837	1176	672	1384	784	1448	1280	872	952	1072	1072	1240	728	744	1192	1160	10,221	120	2	0,1	45			0	Değişikliğe gerek yok.Mevcut Kıt
51257275	2	9	14	17	3	30	9	0	23	6	18	10	6	4	13	8	0,212	120	2	0,1	1			0	Değişikliğe gerek yok.Mevcut Kıt
51257276	4	18	28	34	6	60	18	0	46	12	36	20	12	8	26	16	0,424	120	2	0,1	2			0	Değişikliğe gerek yok.Mevcut Kıt
51257277	6	27	42	51	9	90	27	0	69	18	54	30	18	12	39	24	0,635	120	2	0,1	3			0	Değişikliğe gerek yok.Mevcut Kıt
51257278	2	9	14	17	3	30	9	0	23	6	18	10	6	4	13	8	0,212	120	2	0,1	1			0	Değişikliğe gerek yok.Mevcut Kıt
51257279	2	9	14	17	3	30	9	0	23	6	18	10	6	4	13	8	0,212	120	2	0,1	1			0	Değişikliğe gerek yok.Mevcut Kıt
51257280	4	18	28	34	6	60	18	0	46	12	36	20	12	8	26	16	0,424	120	2	0,1	2			0	Değişikliğe gerek yok.Mevcut Kıt
51257282	2	9	14	17	3	30	9	0	23	6	18	10	6	4	13	8	0,212	120	2	0,1	1			0	Değişikliğe gerek yok.Mevcut Kıt
51257681	186	294	168	346	196	362	320	218	238	268	268	310	182	186	298	290	2,555	120	2	0,1	11			0	Değişikliğe gerek yok.Mevcut Kıt
51257682	93	147	84	173	98	181	160	109	119	134	134	155	91	93	149	145	1,278	120	2	0,1	6			0	Değişikliğe gerek yok.Mevcut Kıt
51257683	93	147	84	173	98	181	160	109	119	134	134	155	91	93	149	145	1,278	120	2	0,1	6			0	Değişikliğe gerek yok.Mevcut Kıt
51257703	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7			0	İşe özel isteniyor. Adet yok. Rafta
51257950	105	174	116	217	114	242	200	120	153	149	179	181	113	105	172	161	1,708	120	2	0,1	8	50		20	Değişikliğe gerek yok.
56920119	74	70	82	24	22	80	32	22	6	36	8	34	24	50	10	108	0,762	120	2	0,1	3		200	200	Değişikliğe gerek yok.
512577702	95	156	101	190	103	211	169	109	143	144	152	165	98	97	162	154	1,489	120	2	0,1	7			0	İşe özel isteniyor. Adet yok. Rafta
21286006B	837	2352	1344	2768	1568	2896	2560	1744	1904	2144	2144	2480	1456	1488	2384	2320	20,442	120	2	0,1	90		200	200	Değişikliğe gerek yok.
21286008B	3852	5094	5382	5562	3654	6858	4392	2934	3636	3960	4248	4482	3150	3672	4644	4914	48,409	120	2	0,1	213		250+250	250	Değişikliğe gerek yok.
51238619FO	74	70	82	24	22	80	32	22	6	36	8	34	24	50	10	108	0,762	120	2	0,1	3		100	100	Değişikliğe gerek yok.
51256305 T0	93	735	420	865	490	905	800	545	595	670	670	775	455	465	745	725	6,388	120	2	0,1	28		5	5	Değişikliğe gerek yok.Mevcut Kıt
51257952A	738	1053	1005	1095	717	1311	879	549	780	771	822	858	585	738	939	939	9,254	120	2	0,1	41		15+15	15	Taşıma arabası yapılacak

According to the new quantities new WIP stocks were calculated. The calculation method was the same as we explained before. We can see the WIP values for raw materials with screws and rivets in table 3.20.

Table 3.20 WIP values for raw materials with screws and rivets

Reference	NEW QUANTIT	2 BOX	TOTAL QUANTIT	Daily Capacity	Daily WIP For New Situation
59904	20	2	40	14,52	2,75
886597	250	2	500	3,24	154,32
1023790	250	2	500	94,68	5,28
1023792	500	2	1000	6,48	154,32
1023793	2000	2	4000	21,6	185,19
1023797	250	2	500	274,32	1,82
1023804	200	2	400	63	6,35
1781757	35	2	70	12,6	5,56
1796860	250	2	500	12,66	39,49
1946501	12	2	24	157,32	0,15
3723674	15	2	30	9,72	3,09
3727187	100	2	200	12,66	15,80
3727348	18	2	36	12,96	2,78
3727437	18	2	36	9,72	3,70
3727438	18	2	36	12,96	2,78
3727441	250	2	500	9,72	51,44
3727782	15	2	30	9,72	3,09
3727786	24	2	48	78,66	0,61
3727789	24	2	48	78,66	0,61
3727934	18	2	36	12,96	2,78
3728209	30	2	60	47,34	1,27
3728290	50	2	100	58,8	1,70
3728711	20	2	40	9,72	4,12
3728785	10	2	20	13,56	1,47
3729274	100	2	200	19,44	10,29
3729342	15	2	30	78,66	0,38
3729866	15	2	30	15,78	1,90
3729868	25	2	50	3,24	15,43
3730677	10	2	20	12,66	1,58
3730678	7	2	14	12,66	1,11
3730679	10	2	20	12,66	1,58
3730700	25	2	50	37,98	1,32
3730747	20	2	40	12,66	3,16
3730875	20	2	40	25,32	1,58
3731133	15	2	30	3,24	9,26
3735451	18	2	36	12,96	2,78
3735504	18	2	36	9,72	3,70
3735508	10	2	20	19,44	1,03
3735524	15	2	30	15,78	1,90
3735530	10	2	20	3,24	6,17
3735531	9	2	18	3,24	5,56
3735532	20	2	40	3,24	12,35
3735533	15	2	30	3,24	9,26
3735536	30	2	60	3,24	18,52
3735537	100	2	200	3,24	61,73
3735543	25	2	50	68,58	0,73
3735566	50	2	100	3,24	30,86
3735568	20	2	40	3,24	12,35
3735574	30	2	60	78,66	0,76
3735574	30	2	60	78,66	0,76
3735583	30	2	60	15,78	3,80
3735602	50	2	100	12,66	7,90
3735603	50	2	100	78,66	1,27
3735605	75	2	150	75,96	1,97
3735606	20	2	40	12,66	3,16
3735607	20	2	40	12,66	3,16
3735608	10	2	20	12,66	1,58
3735609	15	2	30	25,32	1,18
3735610	20	2	40	25,32	1,58
3735611	30	2	60	37,98	1,58
3735612	100	2	200	12,66	15,80
3735615	50	2	100	75,96	1,32
3735617	15	2	30	12,66	2,37
3735627	50	2	100	14,7	6,80
3735638	20	2	40	3,24	12,35
3735784	20	2	40	15,78	2,53
3735804	15	2	30	9,72	3,09
3736435	24	2	48	63	0,76
3736481	30	2	60	137,16	0,44
3736510	30	2	60	157,32	0,38
3736521	30	2	60	157,32	0,38
3736687	işe özel	2		26,22	0,00
3930012	100	2	200	37,98	5,27
3930816	20	2	40	37,98	1,05
3930818	15	2	30	37,98	0,79
21130005	250	2	500	227,88	2,19
21130006	2000	2	4000	14,4	277,78
21167122	250	2	500	15,78	31,69
21167162	250	2	500	12,66	39,49
21167222	250	2	500	12,66	39,49

Reference	NEW QUANTITY	2 BOX	TOTAL QUANTITY	Daily Capacity	Daily WIP For New Situation
21217108	100	2	200	3,24	61,73
21222004	200	2	400	189,36	2,11
21222306	1000	2	2000	75,96	26,33
21222308	250	2	500	3,24	154,32
21234205	0	2	0	6,48	
21253105	250	2	500	25,32	19,75
21253106	200	2	400	151,92	2,63
21253108	100	2	200	63,3	3,16
21253110	200	2	400	9,72	41,15
21253112	100	2	200	63	3,17
21253206	200	2	400	3,24	123,46
21285204	200	2	400	9,72	41,15
21285206	200	2	400	37,98	10,53
21285208	100	2	200	88,62	2,26
21362095	1000	2	2000	29,04	68,87
21380125	100	2	200	25,92	7,72
21431130	200	2	400	94,68	4,22
21431158	200	2	400	25,32	15,80
21431187	500	2	1000	21,6	46,30
21431188	500	2	1000	151,92	6,58
21431192	200	2	400	9,72	41,15
21431195	200	2	400	37,98	10,53
21431218	200	2	400	78,66	5,09
21431219	200	2	400	63,3	6,32
21431221	200	2	400	37,98	10,53
21431224	200	2	400	21,6	18,52
21431250	200	2	400	157,32	2,54
21431251	200	2	400	78,66	5,09
21431252	100	2	200	9,72	20,58
21431252	100	2	200	9,72	20,58
21431254	100	2	200	47,34	4,22
21431281	100	2	200	314,64	0,64
21528188	250	2	500	37,98	13,16
21528220	200	2	400	37,98	10,53
21528251	200	2	400	47,34	8,45
51000501	300	2	600	37,98	15,80
51000504	10	2	20	14,7	1,36
51000596	12	2	24	5,4	4,44
51000689	5	2	10	52,44	0,19
51000704	5	2	10	26,22	0,38
51000727	5	2	10	26,22	0,38
51000738	10	2	20	13,56	1,47
51000782	0	2	0	26,22	
51000821	0	2	0	26,22	
51000939	25	2	50	3,24	15,43
51257117	24	2	48	26,22	1,83
51257237	25	2	50	26,22	1,91
51257242	0	2	0	86,88	
51257275	0	2	0	1,74	
51257276	0	2	0	3,48	
51257277	0	2	0	5,22	
51257278	0	2	0	1,74	
51257279	0	2	0	3,48	
51257280	0	2	0	1,74	
51257282	0	2	0	1,8	
51257681	0	2	0	25,2	
51257682	0	2	0	12,6	
51257683	0	2	0	12,6	
51257703	0	2	0	12,66	
51257950	20	2	40	14,52	2,75
56920119	200	2	400	6,48	61,73
512577702	0	2	0	12,66	0,00
21286006B	200	2	400	173,76	2,30
21286008B	250	2	500	411,48	1,22
51238619FO	100	2	200	6,48	30,86
51256305 T0	5	2	10	63	0,16
51257952A	15	2	30	78,66	0,38
1040201	50	2	100		
3727565	30	2	60		
3735623	20	2	40		
3735565	100	2	200		
3735614	20	2	40		
3735621	10	2	20		
853059	500	2	1000		
56900401	250	2	500		
51000966	30	2	60		
1250 Kelepçe		2	0		
211300006	0	2	0		
TOTAL WIP			**38698**		**2299,439795**
AVERAGE WIP					**17,42**

The WIP values for raw materials without screw and rivets are in table 3.21.

Table 3.21 WIP values for raw materials without screws and rivets

Referenc	New Quantit	2 Boxes	Total Quantity	Daily Capacity	Daily WIP For New Situation
59904	20	2	40	14,52	2,75
1781757	35	2	70	12,6	5,56
1946501	12	2	24	157,32	0,15
3723674	15	2	30	9,72	3,09
3727348	18	2	36	12,96	2,78
3727437	18	2	36	9,72	3,70
3727438	18	2	36	12,96	2,78
3727782	15	2	30	9,72	3,09
3727786	24	2	48	78,66	0,61
3727789	24	2	48	78,66	0,61
3727934	18	2	36	12,96	2,78
3728209	30	2	60	47,34	1,27
3728290	50	2	100	58,8	1,70
3728711	20	2	40	9,72	4,12
3728785	10	2	20	13,56	1,47
3729342	15	2	30	78,66	0,38
3729866	15	2	30	15,78	1,90
3729868	25	2	50	3,24	15,43
3730677	10	2	20	12,66	1,58
3730678	7	2	14	12,66	1,11
3730679	10	2	20	12,66	1,58
3730700	25	2	50	37,98	1,32
3730747	20	2	40	12,66	3,16
3730875	20	2	40	25,32	1,58
3731133	15	2	30	3,24	9,26
3735451	18	2	36	12,96	2,78
3735504	18	2	36	9,72	3,70
3735508	10	2	20	19,44	1,03
3735524	15	2	30	15,78	1,90
3735530	10	2	20	3,24	6,17
3735531	9	2	18	3,24	5,56
3735532	20	2	40	3,24	12,35
3735533	15	2	30	3,24	9,26
3735543	25	2	50	68,58	0,73
3735568	20	2	40	3,24	12,35
3735574	30	2	60	78,66	0,76
3735574	30	2	60	78,66	0,76
3735583	30	2	60	15,78	3,80
3735605	75	2	150	75,96	1,97
3735606	20	2	40	12,66	3,16
3735607	20	2	40	12,66	3,16
3735608	10	2	20	12,66	1,58
3735609	15	2	30	25,32	1,18
3735610	20	2	40	25,32	1,58
3735611	30	2	60	37,98	1,58
3735615	50	2	100	75,96	1,32
3735617	15	2	30	12,66	2,37
3735638	20	2	40	3,24	12,35
3735784	20	2	40	15,78	2,53
3735804	15	2	30	9,72	3,09
3736435	24	2	48	63	0,76
3736481	30	2	60	137,16	0,44
3930816	20	2	40	37,98	1,05
3930818	15	2	30	37,98	0,79
51000596	12	2	24	5,4	4,44
51000738	10	2	20	13,56	1,47
51000939	25	2	50	3,24	15,43
51257242	0	2	0	86,88	
51257950	20	2	40	14,52	2,75
512577702	0	2	0	12,66	
51256305 TD	5	2	10	63	0,16
1040201	50	2	100		
3727565	30	2	60		
3735623	20	2	40		
3735614	20	2	40		
3735621	10	2	20		
51000966	30	2	60		
TOTAL WIP			**2740**		**198,07**
AVERAGE WIP			**40,90**		**3,36**

Finally the improvements for the raw material work in process quantities are 46% (6.2 days reduced to 3.36 days without screws and rivets, 32.10 days to 17.42 days with screws and rivets)

For finished subassemblies the work in process quantities were also changed. Before Kaizen there was a lot of finished subassemblies WIP, because the operators produced to stock without limitation. After Kaizen WIP was limited with two boxes system and the operators worked only if they saw the empty subassembly boxes and they did only the quantity that is written on the box. The box quantities were calculated with the same method of raw material calculations. We have calculated daily capacity of the finished subassemblies before, it can be seen at the table 3.12 . The new box quantities and new work in process quantities for the finished products are in table 3.22. Here the improvement is 68% for finished subassemblies WIP (2.24 days reduced to 0.73 days).

Table 3.22 New box quantities and new work in process quantities for the finished products

	Before Kaizen	After Kaizen	Daily Capacity	Daily WIP For Current Situation	Daily WIP For New Situation
TLP 190 Taban Saçı Hazırlık	6	5	1,8	3,33	2,78
TLP 160 Taban Saçı Hazırlık	6	5	10,86	0,55	0,46
Kelepçe (630)	20	12	63	0,32	0,19
Kelepçe (1250)	15	12	5,58	2,69	2,15
Orta Dikme Hazırlık (CMC)	0	0	2,52	0,00	0,00
Orta Dikme Hazırlık (DM1A)	25	4	12,66	1,97	0,32
Manivela Hazırlık	20	4	12,66	1,58	0,32
Ayarlı Biyel Hazırlık (DM1A)	10	4	12,66	0,79	0,32
Ayarlı Biyel Hazırlık (DM2)		2	1,32	0,00	1,52
Sigorta Altı Komplesi Hazırlık	30	12	9,72	3,09	1,23
Sigorta Kontak Pensi	20	12	12,96	1,54	0,93
Gerilim Gösterge Hazırlık	12	4	14,52	0,83	0,28
Üst Bağlantı	30	12	63	0,48	0,19
Topay Mekanizma Hazırlık	10	4	12,66	0,79	0,32
Bıçak	20	12	12,66	1,58	0,95
Kaynaklı Mil	6	0	12,66	0,47	0,00
Ön Mekanizma	24	4	3,24	7,41	1,23
Arka Mekanizma	20	4	3,24	6,17	1,23
Lale Kontak	20	12	9,72	2,06	1,23
Örgülü Bakır	40	0	3,24	12,35	0,00
Topay Alan Düzenleyici	50	12	37,98	1,32	0,32
İzalotör Hazırlık + Topay Mkn. Montaj	1	0	26,22	0,04	0,00
Takoz	20		9,72	2,06	
TOTAL WIP FOR FINISHED SUBASSEMBLIES	**405**	**136**		**51,41**	**15,95**
AVERAGE WIP				**2,24**	**0,73**

3.2.2.3.3 MPH and Planning Result. With this Kaizen Blitz Project material providing and handling principles was implemented. Two boxes system and little train (material provider) concept were used to replenish the workstations. According to replenishment frequency and MPH principles the box quantities revised and decreased.

With two boxes system, there was no need for order and for a weekly plan in subassembly area. The empty boxes triggered the operators, operators worked only if they saw the empty boxes, if all boxes were full operators go other stations to work; there was a new U-line and a pull flow for this subassembly area.

3.2.2.3.4 Efficiency Result. With new design of the processes the time coefficient KD was improved. As we mentioned before KD is related with design and the equipments of the operation .If the design changes or some new tools are developed which make the operation simpler and easier, the efficiency coefficient will change.

The Kaizen Blitz project manager had to make the time measurement analysis after the project. Total useful times and design times decreased and the efficiency coefficient KD increased. After that he could see the efficiency result of the new process.

Table 3.23 The results of video analysis after the project

	Useful (Green) Time UT	Red Time	Design (Total) Time DT	KD = UT/DT AFTER THE PROJECT
TLP 190 Taban Saçı Hazırlık	465	75	540	86,11
TLP 160 Taban Saçı Hazırlık	273	55	328	83,23
Kelepçe (630) - 3 adet için	97	20	117	82,91
Kelepçe (1250) - 3 adet için	165	24	189	87,30
Orta Dikme Hazırlık (CMC)	63	26	89	70,79
Orta Dikme Hazırlık (DM1A)	57	30	87	65,52
Manivela Hazırlık	79	40	119	66,39
Ayarlı Biyel Hazırlık (DM1A)	20	30	50	40,00
Ayarlı Biyel Hazırlık (DM2)	60	200	260	23,08
Sigorta Altı Komplesi Hazırlık (3 adet)	277	46	323	85,76
Sigorta Kontak Pensi (3adet)	74	13	87	85,06
Gerilim Gösterge Hazırlık	35	11	46	76,09
Üst Bağlantı (3 adet)	34	11	45	75,56
Topay Mekanizma Hazırlık	204	54	258	79,07
Bıçak (3 adet)	200	50	250	80,00
Kaynaklı Mil	340	70	410	82,93
Ön Mekanizma	276	140	416	66,35
Arka Mekanizma	65	20	85	76,47
Lale Kontak (3 adet)	205	25	230	89,13
Örgülü Bakır	0			BUSBAR
Topay Alan Düzenleyici (3 adet)	230	28	258	89,15
İzalotör Hazırlık + Topay Mkn. Montaj	519	205	724	71,69
Takoz				CHASIS

The improvement and the difference between the situations can be seen in table 3.24.

Table 3.24 The improvement of KD

	KD = UT/DT BEFORE	KD = UT/DT AFTER THE PROJECT
TLP 190 Taban Saçı Hazırlık	64,10	86,11
TLP 160 Taban Saçı Hazırlık	57,98	83,23
Kelepçe (630) - 3 adet için	57,20	82,91
Kelepçe (1250) - 3 adet için	76,56	87,30
Orta Dikme Hazırlık (CMC)	59,23	70,79
Orta Dikme Hazırlık (DM1A)	28,00	65,52
Manivela Hazırlık	39,22	66,39
Ayarlı Biyel Hazırlık (DM1A)	26,15	40,00
Ayarlı Biyel Hazırlık (DM2)	18,40	23,08
Sigorta Altı Komplesi Hazırlık (3 adet)	63,30	85,76
Sigorta Kontak Pensi (3adet)	62,96	85,06
Gerilim Gösterge Hazırlık	55,00	76,09
Üst Bağlantı (3 adet)	51,52	75,56
Topay Mekanizma Hazırlık	45,69	79,07
Bıçak (3 adet)	38,05	80,00
Kaynaklı Mil	78,05	82,93
Ön Mekanizma	44,74	66,35
Arka Mekanizma	32,95	76,47
Lale Kontak (3 adet)	55,56	89,13
Örgülü Bakır	72,81	BUSBAR
Topay Alan Düzenleyici (3 adet)	57,38	89,15
İzalotör Hazırlık + Topay Mkn. Montaj	51,15	71,69
Takoz	40,54	CHASIS

3.2.2.3.5 PLT Result. We have analysed the processing lead times and the production lead times for the operations before. Total production lead time is the sum of inventory waiting times. Lead time was calculated by dividing the inventory and work in process quantity to the daily customer requirements. We knew the daily customer requirements and WIP. After the Kaizen Blitz Project the WIP quantities were reduced, because of this the project manager calculated new lead times for the processes. The new lead times and the improvement can be seen at the table 3.25.

Table 3.25 The improvement of lead times

	Quantity (2006)	Quantity (2007)	Total	Working Days (Total 2006, 2007)	Daily Quantity	Shift	Working Time (min)	Takt Time Realised (Working time/daily quantity)	Monthly Cmax	Yearly Cmax	Daily Cmax	Takttime for the Cmax (Working time/daily quantity)	Before WIP for the current situation	PLT - Before	After WIP	PLT - After	Difference
TLP 190 Taban Saçı Hazırlık	141	31	172	329	0,52	1	510	975,523	36	432	1,8	283,33	6	11,48 days	5	9,56 days	1,91 days
TLP 160 Taban Saçı Hazırlık	1587	478	2065	329	6,28	1	510	81,254	217,2	2606,4	10,86	46,96	6	0,96 days	5	0,80 days	0,16 days
Kelepçe (630,1250)	9009	2730	11739	329	35,68	1	510	14,293	1371,6	16459,2	68,58	7,44	35	0,98 days	24	0,67 days	0,31 days
Orta Dikme Hazırlık	2075	612	2687	329	8,17	1	510	62,445	294	3528	14,7	34,69	25	3,06 days	4	0,49 days	2,57 days
Manivela Hazırlık	1738	511	2249	329	6,84	1	510	74,606	253,2	3038,4	12,66	40,28	20	2,93 days	4	0,59 days	2,34 days
Ayarlı Biyel Hazırlık	1857	544	2401	329	7,30	1	510	69,883	271,2	3254,4	13,56	37,61	10	1,37 days	4	0,55 days	0,82 days
Sigorta Altı Komplesi Hazırlık	777	288	1065	329	3,24	1	510	157,549	194,4	2332,8	9,72	52,47	30	9,27 days	12	3,71 days	5,56 days
Sigorta Kontak Pensi	1401	441	1842	329	5,60	1	510	91,091	259,2	3110,4	12,96	39,35	20	3,57 days	12	2,14 days	1,43 days
Gerilim Gösterge Hazırlık	1950	551	2501	329	7,60	1	510	67,089	290,4	3484,8	14,52	35,12	12	1,58 days	4	0,53 days	1,05 days
Üst Bağlantı	8991	2709	11700	329	35,56	1	510	14,341	1260	15120	63	8,10	30	0,84 days	12	0,34 days	0,51 days
Topay Mekanizma Hazırlık	1738	511	2249	329	6,84	1	510	74,606	253,2	3038,4	12,66	40,28	10	1,46 days	4	0,59 days	0,88 days
Kaynaklı Mil - Bıçak	1738	511	2249	329	6,84	1	510	74,606	253,2	3038,4	12,66	40,28	26	3,80 days	12	1,76 days	2,05 days
Ön Mekanizma	245	96	341	329	1,04	1	510	492,053	64,8	777,6	3,24	157,41	24	23,16 days	4	3,86 days	19,30 days
Arka Mekanizma	245	96	341	329	1,04	1	510	492,053	64,8	777,6	3,24	157,41	20	19,30 days	4	3,86 days	15,44 days
Lale Kontak	777	288	1065	329	3,24	1	510	157,549	194,4	2332,8	9,72	52,47	20	6,18 days	12	3,71 days	2,47 days
Örgülü Bakır	245	96	341	329	1,04	1	510	492,053	64,8	777,6	3,24	157,41	40	38,59 days	0	0,00 days	38,59 days
Topay Alan Düzenleyici	5214	1533	6747	329	20,51	1	510	24,869	759,6	9115,2	37,98	13,43	50	2,44 days	12	0,59 days	1,85 days
İzalotör Hazırlık	3526	1067	4593	329	13,96	1	510	36,532	524,4	6292,8	26,22	19,45	0	0,00 days	0	0,00 days	0,00 days
Takoz	777	288	1065	329	3,24	1	510	157,549	194,4	2332,8	9,72	52,47	20	6,18 days	0	0,00 days	6,18 days
Topay Mkn. Montaj	1997	607	2604	329	7,91	1	510	64,435	315,6	3787,2	15,78	32,32	1	0,13 days	0	0,00 days	0,13 days

3.2.2.3.6 Some Fotos for new developed tools.

BEFORE

AFTER

BEFORE

AFTER

Figure 3.19 Some fotos for new developed tools

CHAPTER FOUR
CONCLUSION

4.1 Conclusion

In this thesis implementation of the Kaizen Blitz approach, known as one of the principles of the total quality control applications and lean manufacturing, in an electronic company is presented.

First, benefits of the Kaizen and Kaizen Blitz approaches are analyzed and their tools are presented with all aspects. Then, the structure of company is introduced, and the problems faced by the company are examined due to the Deming cycle and its plan, do, check, act stages. In the planning stage of this cycle, value stream of the company is studied and the area of the Kaizen Blitz implementation is decided. After the bottleneck situation for the Kaizen Blitz execution was selected, implementation steps are determined and necessary data are gathered. As a result causes of non value added activities and wastes are identified and eliminated. Future state is analyzed and new flows and new layouts are developed. At do stage of Deming cycle, new design is realized. Finally, at check stage, the results that are obtained from the Kaizen Blitz approach are analyzed and compared with the status before the execution of the approach.

Expected improvements as a result of Kaizen Blitz implementation are reduction in lead time and inventory, improvement in productivity, savings in floor space and increase in customer satisfaction.

4.2 Future Directions

In this study, the Kaizen Blitz Project in the production environment is analysed. For future directions, the Kaizen Blitz approach can be implemented for the company's offices and service activities. If there are some problems in extended value stream, it can be implemented also for the suppliers and for the customers of the companies. The benefits of Kaizen Blitz for these areas can be compared with the results of projects which are conducted in production.

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APPENDIX

The flowchart of the project