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M.Sc. in Industrial Engineering

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REPUBLIC OF TURKEY

GAZİANTEP UNIVERSITY

GRADUATE SCHOOL OF NATURAL & APPLIED SCIENCES

DEVELOPING AND IMPLEMENTING A WAGE ASSESSMENT METHOD BASED ON THE 5S PERFORMANCE SCORE: AN APPLICATION OF STEEL CONSTRUCTION FACTORY

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Supervisor

Prof. Dr. Serap ULUSAM SEÇKİNER

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Mehmet Burçin ÖNAY

ABSTRACT

DEVELOPING AND IMPLEMENTING A WAGE ASSESSMENT METHOD BASED ON THE 5S PERFORMANCE SCORE: AN APPLICATION OF STEEL CONSTRUCTION FACTORY

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To be a global company, it must be the goal of all managers to remove wasted resources and achieve an effective workflow. Our working environments tend to be irregular and untidy at all times, due to the dynamic nature of their existence. One of the basic tools of providing this arrangement and order in the workplace is the 5S applications. In this context, especially 5S application which is being used in the industry has some superiorities such as easily carrying out, increasing the participation and satisfaction of the employees. In job evaluation studies, jobs are evaluated according to predefined factors and then their values are defined with respect to each other. Then wage curves are drawn and wage brackets are set for each point interval over these values. In this study, 5S scores were used in the evaluation of success (merit) factor in the internal structure of wage brackets in order to increase the employee's belief in the objectivity of the wage assessment system. Thus, a new wage assessment method, in which both lean manufacturing and job analysis and evaluation system are integrated, has been developed and implemented. This application gave solutions to chronic problems of the applied factory, where workers were slowing or stopping works because of wage increment dissatisfactions in additionally to unhealthy, dirty and untidy work environment and low occupational safety preventions.

Key Words: Job Analysis, Job Evaluation, Wage Assessment, Lean Manufacturing, 5S Method, Job Performance, Steel Construction.

ÖZET

5S PERFORMANS PUANINA DAYALI ÜCRET DEĞERLEME METODU GELİŞTİRİLMESİ VE UYGULANMASI: BİR ÇELİK KONTRÜKSİYON FİRMASI UYGULAMASI

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Dünya çapında firma olmak için israfı ortadan kaldırmak ve etkin bir iş akışı gerçekleştirmek tüm yöneticilerin hedefi olmalıdır. Çalışma ortamlarımız, sahip olduğu dinamik yapısı nedeniyle her zaman düzensizliğe gitme eğilimindedir. İşyerinde bu tertip ve düzeni sağlamanın temel araçlarından birisi 5S uygulamalarıdır. Bu bağlamda, özellikle endüstride kullanılmakta olan 5S uygulaması kolayca yürütülebilen, çalışanların katılımını ve memnuniyetini sağlayan bir uygulamadır. İş değerlendirme çalışmalarında, işler belirli faktörler açısından değerlendirilir ve birbirine oranla taşıdıkları değerler belirlenir. Daha sonra bu değerler üzerinden ücret eğrileri çıkarılır ve ücret kademeleri belirlenir. Bu çalışmada çalışanın ücret değerlendirme sisteminin objektifliğine olan inancını arttırmak amacıyla ücret kademelerinin iç yapısında başarı (liyakat) faktörünün değerlendirilmesinde 5S puanları kullanılmış, böylece yalın üretim ile iş analizi ve değerlendirme sisteminin birbirine entegre edildiği yeni bir ücret değerlendirme yöntemi geliştirilerek uygulanmıştır. Bu uygulama, sağlıksız, kirli ve düzensiz çalışma ortamına ve düşük iş güvenliği önlemlerine ek olarak ücret artış memnuniyetsizlikleri nedeniyle çalışanların işleri yavaşlatma veya durdurma problemleri yaşayan fabrikanın kronik sorunlarına çözüm getirmiştir.

Anahtar Kelimeler: İş Analizi, İş Değerlendirme, Ücret Değerleme, Yalın Üretim, 5S Metodu, İş Performansı, Çelik Konstrüksiyon.

To My Teachers, Parents and Family…

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LIST OF ABBREVIATIONS

5S	Seiri (Classification or Sorting), Seiton (Tidiness or Setting), Seiso (Cleanness or Sweeping), Seiketsu (Standardization), Shitsuke (Discipline of Sterness)
AHP	Analytical Hierarchy Process
ANP	Analytical Network Process
GDP	Gross Domestic Product
HRM	Human Resources Management
JIT	Just in Time
KRK	Near Miss
MCDM	Multi-Criteria Decision Making
MESS	Metal Industrialists Union
MIG	Metal Inert Gas
MTM	Method Time Measurement
SMED	Single Minute Exchange of Dies
TIG	Tungsten Inert Gas
TLA	Team Leader Candidate
TPM	Total Productive Manintenance
TQM	Total Quality Management
TV	Television
USA	United States of America
VSM	Value Stream Mapping
WIP	Work in Process
WLB	War Labor Board

CHAPTER 1

INTRODUCTION

Globalization has inevitably influenced the whole world. The number of competitors is increasing day by day for companies operating in almost every sector. Therefore, businesses have to continuously develop their competitiveness skills to survive. One of the most important ways of achieving success in competition is to invest in human resources, which is the most important value of enterprises and to use this resource most efficiently [1]. Personnel management is a set of administrative tasks, such as hiring and turning off staff and archive arrangement, payroll preparation. In human resources management; with the understanding that man is the most valuable capital for the enterprise, new tasks are added to the tasks within the scope of personnel management that require more expertise. Although personnel management is the basis of human resources management, there are significant differences between them. Personnel management is an administrative function that regulates the technical relations between the employee and the enterprise and aims to keep labor costs to a minimum. Human resource management, on the contrary, sees the labor force as an important factor of production and as an important element of creating added value.

In this thesis, the 5S tool of lean production was used as a performance factor. Human resources management sees humans as the most valuable asset of the enterprise [2] and 5S is an important tool that supports this claim and reflects it to real life. There is a direct relationship between long term operational performance and employee behavior outcome and it is conditioned by the physical work environment [3]. And also human factors management is one of the most important success factors of lean deployments [4]. Therefore, the 5S tool of lean production was used for performance measurement. In this way, it is aimed to increase the sense

of belonging of the employees to their businesses by having a sense of devotion and to provide the highest possible level of performance.

In this thesis, material and resource data were obtained from the manufacturing area of Çiltuğ Heat Industry and Trade Incorporation. This company had also a problem with low productivity and performance rates. Where completed projects' man-hour/ton rates were more than bidding values which are required to be the target of the production department. And also they had faced with work slowing or stopping actions of workers because of wage increment dissatisfactions related to injustice between workers or convenience with promised levels. Also, there were unhealthy, dirty and untidy work environments and low occupational safety preventions. Due to these reasons, we tried to find a solution that overcomes these problems.

Therefore, the 5S method of lean manufacturing is applied which was used as a performance evaluation tool. And also KAIZEN tool of lean manufacturing is stated as a used form in this study. After the application of these lean tools, work analysis, evaluation, work point calculations, salary system applications are disclosed respectively. Finally, the wage increment method is applied according to 5S team points.

In the searched literature, any study hasn't been seen that combines job evaluation and any lean manufacturing tool. Because of this gap in the literature, this study has an important originality value for the literature. In the wage model, both job evaluation results and lean manufacturing performance scores were included, this is a novel and innovative approach for lean management.

1.1 Human Resources Management

Human Resources Management; is a set of activities formed in an institution to increase the effectiveness of employees. In other words, it is the unit that is responsible for organizing and executing the activities that will activate the human resources in the enterprise in the most effective way to achieve the corporate objectives [5].

Human Resources Management (HRM) is based on 2 basic philosophy;

- Efficient use of manpower in line with the business objective

- Ensuring the fulfillment and development of employee requirements

HRM aims the continuity of workers' activities with high performance in the company, on the other hand, increase the quality of life of the employees. Thus, labor productivity will increase and the employee will be satisfied with the work. HRM aims to introduce all support activities for the hiring, placement and training of personnel (managers or workers) and the continuous improvement of the effectiveness.

1.1.1 Functions of HRM

Among the fields of human resources management are; human resources planning, job analysis, job description, selection of appropriate human resources, training and development, career planning, performance evaluation, remuneration, establishment of business culture, increasing employee motivation, job satisfaction, stress and conflict management, ensuring a healthy and safe working environment and industrial relations. Human resources functions are summarized below.

a) Human Resources Planning: The most appropriate qualification personnel who can contribute to the general planning objectives including the organization planning of the enterprise is to be put into operation in the most appropriate time, to be placed in the most suitable business department, to prepare new tasks by in-service training, to evaluate their success and to operate most efficiently. The main objective of manpower planning is to increase the efficiency and productivity of employees and control labor costs in production.

In this study, employees within the enterprise were divided into 5S teams according to their skills and specialties, and each team leader was provided with 2 hours of training a month on average. The training objectives are also included in the calculation of the team scores. Also, to increase production performance and reduce labor costs, each team member was given the goal to make at least two kaizen proposals per month and to realize at least one. And of course, this is included in the calculation of the team score.

b) Job Analysis: To evaluate the works correctly, effectively, and soundly, it is a technique that examines the nature, quantity, requirements, responsibilities and working conditions of each work in the institution/organization with scientific

methods. Job Analysis constitutes the infrastructure of Human Resources Management. Job analyzes are important inputs in the execution of Human Resources processes such as personnel selection, promotion, and performance evaluation in the organization of works and organizational structure.

In this study, the job analysis of the key works was conducted that are determined by the management for the job evaluation.

c) Employment and Placement: It includes the finding, interviewing, testing, healthy inspection and recruitment procedures of available personnel that fulfills the requirements of the job.

In this process, which is aimed to reach maximum applicant to the organization, by using the internal and external resources of the organization, it is aimed to provide this using job advertisement, internet, and participation to the career days, increasing the number of applications and attracting high-qualified personnel to the organization.

Personnel selection is the process of recruiting the most suitable person from the applicants to the qualifications determined in the job analysis process. In the process, the potential of the candidate to adapt to organizational values and culture should be analyzed. Thus, it is possible to select the candidate who can exhibit the behaviors and attitudes that the organization expects.

Thanks to the job analysis conducted within the scope of the job evaluation work, the basis for the selection of the personnel to be commissioned has been established.

d) Education and Career Development: Education is the activities carried out to adapt to change, increase employees' knowledge and skills, change their attitudes and behaviors and prepare employees for new tasks. The main objective of training and development is to adapt the employee to changing environmental conditions. For this reason, large investments are made in education on a global scale and various training techniques are used. The most widely used techniques are in-company, out-of-company and on-the-job training.

With the determination of career steps, training and development programs are organized for the employee following their career goals. Thus, the employee is given

appropriate knowledge, skills, technical knowledge, and career sufficiency. The primary purpose of such programs is to analyze the skills and interests of the employees and thus to align the employees' growth and development needs with the organization's objectives.

In previous chapters, it was mentioned that, since the employees were given monthly training goals, this was the responsibility of the team leader and influenced the team score.

e) Job Evaluation and Wage System: Job evaluation is the mathematical determination of the ratio of the qualifications that the worker must have to perform a job. These qualifications are mostly assessed over education, experience, and ability. And the requirements subjects of jobs are skill, responsibility, physical effort, and mental effort.

In this study, the job valuation and compensation studies are done by using AHP and geometric sequences.

f) Performance Evaluation: Performance evaluation is the process of scientific and systematic monitoring of employees in terms of personality, job success and development potential, ie a process of judging the employee's degree of success at work. In this context, evaluation should focus on core business responsibilities, role behavior, and organizational behavior. Organizational behaviors including self-help and helping other colleagues can strengthen organizational processes and inter-employee relations.

Performance measurement is based on predefined performance criteria; to determine the performance of employees. For this, performance interviews are usually carried out every six months. Performance interviews cover all tasks and activities agreed upon in the previous interview and include the objectives of the next period.

In this study, 5S team scores were determined as performance criteria and wage increases were determined according to these team performance scores.

g) Industrial Relations: As a result of the negotiations with the union, collective bargaining agreements are organized in case of agreement on wages and other social issues.

h) Occupational Health and Safety: Taking the measures to protect employees from occupational accidents and occupational diseases and informing them on this issue is the basis of occupational health and safety. Human resources management is obliged to fulfill the legal practices in this respect.

The physical and mental health of employees in a workplace affects their use of their knowledge, skills, and abilities. Becoming in the sense of health and safety strengthens the commitment of employees to work. Organizations should provide appropriate occupational health care to meet the needs of all workers to protect their working life from health risks; develop health criteria for the protection of workers against biological, chemical and physical hazards; To reduce the risk factors associated with work, technical and educational measures should be implemented and should ensure that safety of particularly vulnerable workers is ensured.

In this study, 5S team members were given the goal of giving at least one near-miss suggestion per month and realizing one of these suggestions at least every 2 months. At the same time, this target is provided to influence the team scores.

i) Personnel Affairs: Recruitment procedures, payroll preparation, the fulfillment of legal responsibilities, and dismissal are mandatory procedures of all organizations for all personnel and are the most fundamental function of human resource management.

Relationship of HRM and Productivity: Studies show that HRM practices have strong and significant effects on productivity, quality of working life and profitability. In particular, the decline in productivity rates in the USA and Europe since the early 1970s has led to a decline in the quality of management (Appendix 1).

The error in the Motorola plant in Illinois, which produced color TV in 1970, was 150-180 per 100 TV sets, but in 1980 the error rate fell to 3-4 per 10 TV sets after a Japanese company took over the facility management. Participation of employees in the decision-making process, assuming responsibility for product quality and strengthening communication between management and employees resulted in direct product quality improvement.

1.2 Job Analysis

Nowadays, it is necessary to have detailed information about the work done to solve the issues such as human resources functions, which are not solved yet and the important problems of many enterprises, to make the workforce planning, to recruit the appropriate personnel, to determine and to give the necessary training, to evaluate the performance, to determine the fair wage of the personnel.

Job analysis is a scientific and technical study that shows the situation of a work and its situation in terms of various factors and its difference from other works. In other words, job analysis is defined as the process of determining what a job is, why and how it is made, what the qualifications for its performance are. Employee services such as recruitment in the organization, evaluation of payment duty, in-service training cannot be carried out without this information [6].

Job analysis is the collection, evaluation, and organization of the necessary information about the works being done in a particular enterprise. Or job analysis is a process in which the general situation and characteristics, the environment and working conditions of the work will be collected, the systematic review and evaluation of the collected data and the information related to them are written in writing.

Job analysis is the process of detailing and examining the smallest parts of a particular job. Collecting, evaluating and organizing information related to all different jobs within the enterprise [7]. Employee services such as hiring, job evaluation, wage compensation (fair), training, etc. cannot be realized without job analysis.

1.3 Lean Manufacturing

After the Second World War, Eiji Toyoda and Taiichi Ohno from the Toyota Motor Plant in Japan pioneered the concept of lean production. With the Japanese companies and industries copying this extraordinary system, Japan soon reached its economic superiority.

Today, manufacturers all over the world are trying to adopt lean production, but development is progressing. The first skilled companies in this system are in Japan.

Lean production was spreading in North America and Western Europe under their auspices, while trade wars and growing resistance to foreign capital followed. From the 1980s onwards, intensive efforts are being made in the transition to the lean manufacturing system in the world.

Lean manufacturing is being implemented in various companies in Turkey. Since 2014, Çiltuğ Isı San. and Tic. Inc. has carried out many studies to integrate lean production into the production system. Since 2014, the company has been conducting many studies to integrate lean production into the production system.

1.3.1 Lean Approach

The main objective of lean thinking is to rapidly reach the final customer starting from the first raw material through a continuous flow throughout the value creation process. To achieve this, it is necessary to look at the whole value chain in a framework of integrity, to eliminate wastage and to direct all activities to create a perfect value for the customer.

Waste in lean thinking is everything that the customer does not agree to pay the extra price, which does not offer any benefit to the user of the product or service beyond its known meaning. All kinds of wastage (errors, overproduction, inventories, waiting, unnecessary work, unnecessary movements, unnecessary transports) are provided to be eliminated from design to shipment in all product/service creation stages. Thus, it is aimed to reduce costs, increase customer satisfaction, gain flexibility in adaptation to market conditions, accelerate cash flow and increase firm profitability [8].

1.3.2 Basis and Development of Lean Thinking System

Toyota is the first and best implementer of lean production. The origins of this approach have emerged during the trip to the United States with the Toyota executives of Taiichi Ohno, who form the basis for the Toyota production system. They aimed to develop production systems that could compete with American companies. At that time there were mass production systems developed by Henry Ford in America and still used today. This system is based on the prediction of production and quality control after production. This system is not adopted by Taiichi Ohno. Instead of this, they started to work on a study which is called “Toyota

Production System". Toyota has achieved great success with this system. While Toyota's name wasn't in the list of world's largest companies list, it became 6'th in 1970, 3'rd in 1990, and finally became 2'nd after General Motors. This increase was achieved by reducing labor times by less than 10 times less labor force, fewer labor hours (16 hours compared to 31 hours), fewer errors (45 errors compared to 145 errors per hundred cars) and die exchange duration in large presses from 8 hours to 3 minutes.

The basic principle that the Toyota Production System added to the industrial world was to produce everything at the time and at the customer's request and to eliminate all unnecessary stocks. The stock was perceived as waste and there was no waste in the system. Each production step was only triggered by the cards called Kanban to produce at the time and quantity needed by the next step. This logic has been implemented in the chain of suppliers as well as a system that produces when demand becomes, which minimizes stocks and by the way, a system was created using resources more efficient and minimizing stocks.

The managers of workshops manage new roles through additional training. There are not many engineers as managers in the workshops. Engineers are engaged in engineering.

The production, which had been being done in larger lots than the requirement and before needed time, became very feasible in small batches, just as much as the customer wants by the achievement of very fast mold changing techniques (SMED).

The layout of the machines was rearranged to match the flow order of the products between the stations, allowing the products to flow rapidly between processes without waiting. Usually, in the form of a U-shaped machine arrangement, a worker is held responsible for more than one machine, thus preventing both work monotony and saving labor.

As the safety stocks were at the lowest level, all operations had to be done faultlessly and the machines should not be damaged. The available time of the machines was approached to 100% with "Total Productive Maintenance" techniques (TPM). Providing order and cleanliness in the work environment (5S) was a way to prevent both errors and time wastage.

To maintain % 100 error-free rule, workers can stop production at the time of the error to find out the causes of the failure. Rather than discovering the error by the worker, the production lines used the "poka-yoke" sensors and error-catching hardware, which prevented the automatic detection of the error as soon as it occurred.

Another method developed to avoid errors in the system was the standardization of business. All the works were divided into units and they were hanging on the boards in the form of drawings. The worker makes all his movements according to the standard business procedure; consistency was maintained in terms of safety, production speed, and quality. The standardization of the work also allowed the new worker to adapt quickly to the job, even in cases of job rotation.

One of the key features of the Toyota Production System was its respect for people. This respect was evident both in wages and in recruiting employees as the most important actors to further develop the system. The safety and security of the employees, the tidiness of the work environment, the cleanliness of the work environment, the working standards and ergonomics are outstanding elements. Everything is done to enable employees to do their work in full and to take part in continuous development activities [9].

Experts who work in human resources position work in production activities in shifts in workshops from one week to six months. Experts, engineers who complete their orientation in this way show deep respect for the employee.

Lean manufacturing is defined as the production system which has no unnecessary elements in its structure and minimizes the factors such as error, cost, stock labor, development process, production area, waste, customer dissatisfaction.

Six success factors characterize lean production. These are; project manager, teamwork, information culture, integration with suppliers, simultaneous engineering, consumer orientation. Among them, teamwork, project manager and integration with consumers are the factors that distinguish the concept of lean manufacturing from the less competitive alternative to the concept of Tayloristic structured production. Figure 1.1 shows the success factors of lean production.

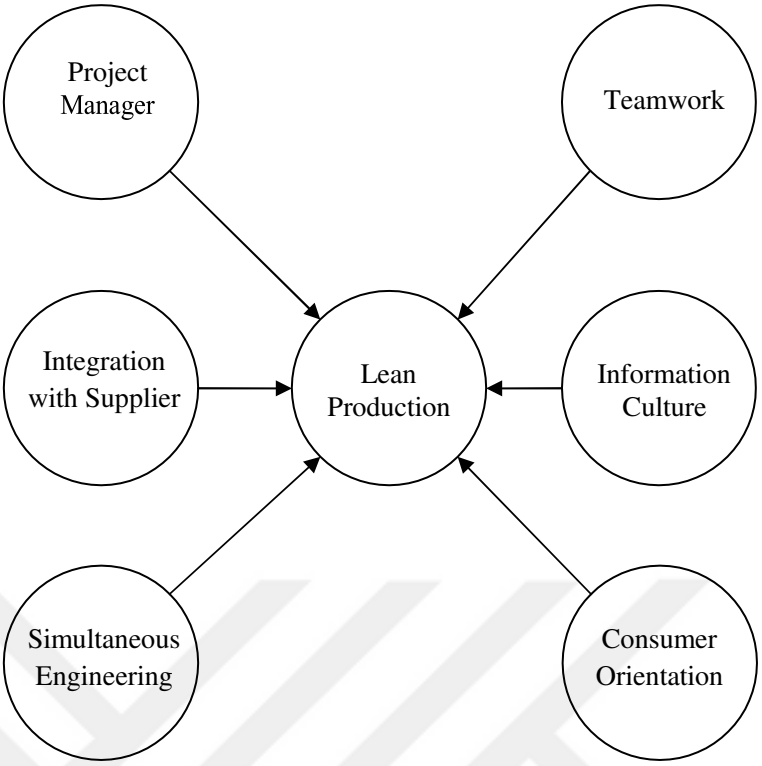

Figure 1.1 Success factors of lean production [10]

At the root of this approach, which aims to implement the key factors in Figure1.1, there is the "Total Quality Control System" that changes the quality meaning and system. This system, which adopts that quality is not the responsibility of a single department such as "Quality Control" or "Quality Assurance", is gradually becoming one of the cornerstones of lean production. Because the goal in lean production; to produce the right goods at the first moment by producing faultless quality goods.

Quality understanding of lean production; when the customer buys a good or service, he/she hopes that what he/she needs exists in the goods or services and that all the expectations that will be needed during the use are met completely. In brief, lean manufacturing has brought new dimensions to quality understanding.

Researcher John Krafchik, defines lean production as a production system that has no unnecessary elements in its structure and minimizes the factors such as error, cost, stock, labor, development process, production area, waste, customer dissatisfaction.

Lean production is “Simple” because it uses less of everything compared to mass production. It also requires less than half of what is needed on-site, produces more products, less faulty goods and produce more diversified products.

The most striking difference between mass production and lean production lies in its main purpose. Serial manufacturers assign a limited target to them. This means the maximum number of standardized products. Doing better, according to this understanding will be too expensive or will exceed the human's natural abilities. On the other hand, lean manufacturers have targeted perfection. Continuous falling costs, zero corrupt goods, zero stock, etc. The lean manufacturer is constantly seeking perfection to achieve this goal [11].

A feature of lean production is that lean production changes the way people work. The main objective is to spread the responsibility of the structural pyramid of the organization to the following persons. Responsibility means freedom to control someone's work, but it also raises concerns about making expensive mistakes.

Lean manufacturing requires more professional skills to be learned and implemented in a creative atmosphere rather than a rigid hierarchy.

1.3.3 Lean Production Techniques

1.3.3.1 5S

5S is a, “Workplace Organization Process” which aims to bring accessories, hand tools, materials, documents and information close to the relevant machine and technician. The 5S is the first step on the road to lean production, aiming to get the operator to avoid looking for the inputs to start work at the site [12]. The purpose of the 5S application is to remove unnecessary materials from the working environment, to regulate the environment and to reach the material easily. 5S starts with the correction of each process [13].

The facilities maintain their salaries in line with a certain system in order not to experience labor and productivity losses. Problems are easily detected when order is established, easy to interfere with problems. With the 5S systematics, various training is given to the employees. As a result, there are positive approaches to the facility in terms of employees' perspectives. In regular workplaces, employees spend

time on the question of how to solve their attention and energy rather than to answer the question of why. 5S systematics contributes to the awareness of the employees so that the facilities are constantly open to improvement. 5S systematic issues such as occupational safety, machinery and equipment, quality, workplace layout, and cleanliness reach a certain level. This contributes greatly to the productivity and motivation of employees.

5S is a system that can be implemented directly by employees. 5S systematics provide employees with a safe working environment, feels the sense of belonging to the workplace and improves teamwork. The working safety environment depends on the perception of the employee as well as the quality of the environment [14]. 5S systematics requires all employees to apply effectively. To achieve the desired success in the application and to ensure the continuity of the company from the top management to the level of the operator's belief in the methodology and support everyone is the requirement [15]. This philosophy, as a management tool, has enabled the establishment of an effective working environment and has become more and more often applied in corporate enterprises in recent years [12]. The application steps of 5S can be briefly summarized as follows:

1. **Seiri, Classification or Sorting**

   The sorting process is the process by which materials that are no longer needed are removed from the working environment. Sorting promotes the separation of useful and useless devices, thus forming the basis for removing unused material [16]. The sorting step is based on the classification of everything in the area studied from start to finish. The aim here is to remove unnecessary materials from the environment and put them from the wrong place to the right place. What is necessary for the realization of the classification is to separate things from unnecessary things and to keep them as small as possible and appropriate [17]. Many facilities hold in hand the idea that they will need some equipment one day, even though they will never need them. Such unnecessary materials and equipment, after a while, cause various problems. Unnecessary material eventually becomes garbage. If the sorting process is done, another part may be needed for the separated material. Thus, it is saved from being dumped. Items should be kept in the environment as long as they work. In

this context, it is very important to know what is to be discarded, what is stored, how to store it and how to reach it later. Then the sorted material is classified.

2. **Seiton, Tidiness or Setting**

In the working environment, the materials and equipment that are constantly needed, in a short time and easy to find and use is the setting phase [12]. The purpose of the arrangement is to keep where the necessary material is kept, how it is stored, how easy it is for everyone and to make it easier to recognize when the material is not in the right place. In this step, each material is given a name during the arranging process. Then the site is determined according to the frequency of use and labeled accordingly. This process is carried out collectively with the participation of all employees. The main purpose of tidiness is to be a place for everything and everything is in place. Although untidiness cause problems, people leave their areas untidy. People can be stuck, staggered, or tipped over, passing through places where objects are left randomly to the pedestrian paths, and if the transitions are not fully defined, forklifts and cars can move towards parts, equipment, and people. Exposed and defective, enclosed cables, irregular or hazardous chemicals stored, irregularly controlled or stocked end-of-life materials may be hazardous. The time to search for materials, parts or files adds unnecessary time to the process. The arrangement can be in any form in each area. As with the arrangement of goods and materials, road markings and information boards on highways can be used to draw people's safety [18].

3. **Seiso, Cleanness or Sweeping**

To provide a clean and well-maintained working environment and to keep the materials and equipment clean and to protect them [12]. Cleaning; is not just making items appear beautiful by clearing them. It is always a way of keeping the working area and equipment in top working conditions and processing the problems [18]. For a clean environment, it is necessary to avoid pollution that may occur first after performing the sorting and setting steps. First, it is necessary to determine the causes of pollution and remove

the source of pollution. Then machinery and equipment should be arranged in a way that can eliminate pollution easily and quickly. Every worker should perform the cleaning and basic preventive maintenance of his / her vehicle and the working area. In this way, everything can be kept clean. At this stage, which material, by whom, with which material to be cleaned is planned. The employee of his work area is obliged to keep clean. The rules for workplace safety are followed during cleaning. The working environment is then ready for the next working day. Cleaned equipment can be used for the longer term. In this way, the lost time and labor for maintenance and repair is reduced.

4. **Seiketsu, Standardization**

Standardization is to ensure the continuity of those applied in the sorting, setting and cleaning steps in the 5S application. The application steps need to be checked to make it continuous. The standardization step is very important for the continuity of the other steps because it is not about doing a new activity, but about maintaining the conditions you want in your workplaces. Here the target is that the necessary items are in the working area. Being the rest of everything in own place and is to replace them. Ensuring that cleaning and order are maintained is far more efficient than stopping production and cleaning again in the long run. The main purpose of standardization; to create key points to maintain improved conditions in your workplace. Standardization is done for visualization of sorting and cleaning applications. At this stage, the monitoring and maintenance of the 5S conditions are essential. The problems are addressed through teamwork. Continuous improvement is ensured by rearranging as necessary. The shelves are labeled to ensure that everything is in place. When determining the control steps for standardization, we first decide what and how to standardize.

5. **Shitsuke, Discipline or Sternness**

It is the step that integrates 4 steps and covers the whole process. In addition to ensuring continuity in all business processes; training of employees, the establishment of loyalty, announcement of improvements,

campaigns and rewarding of working groups [12].

The rules should be adopted and implemented by all employees. Top management support is essential for the proper implementation of this step. Plans should be made in disciplinary practice and both pieces of training and controls should be maintained in line with this plan. All employees should be informed about the 5S systematic. Thus, the employee, who sees what is done and its benefits, continue to practice in a disciplined manner. One of the most important issues here is the visual support of the applications. In this way, the disciplinary step is applied through continuous reminders.

1.3.3.1.1 Benefits of 5S Systematics for Businesses

The 5S application does not apply to facilities because it only brings visual beauty. 5S activities provide employees with several important benefits that will affect their work, motivation, and performance. The most important of these benefits is occupational safety. Because if the area studied is more regular and clean, then it becomes safer to maintain business activities in that environment. After ordering and cleaning, workplaces eliminate unnecessary material that will cause work accidents. It removes the scattered materials that cause fires and explosions.

Arranged items prevent accidents that may occur during this process, as it is easy to access. It also reduces the time spent searching for items. It is easier to find this material if any material is missing. The facility is immediately noticeable if there is an abnormal condition. Problems are detected faster and easier.

With the visual signage and writings prepared, it shows how the items will stand and how they behave and how people behave. The labeling step allows people to locate machines, equipment, and items easily and without losing time. One of the most important points is that working in a clean and organized environment provides morale and motivation for those working in that environment. Ownership and commitment to work increases.

Failures are easily detected in the right place at the right time and machine failures are minimized. This system is a system where all employees will participate and develop a sense of togetherness. Daily cleaning will be used for raw materials,

machinery, equipment so the working environment will be clean. Thus, both the resulting product quality and the presence of faults in the machines are increased. Employees are given various responsibilities in the 5S application. In this way, when employees become more competent, their commitment to their work increases. People implement the system with suggestions that will motivate each other. This increases teamwork.

1.3.3.2 SMED (Single Minute Exchange of Dies)

The reason given to the stock working in the mass production system is that the passing time is too long in the machines to obtain a product without error from one mold to the other. The longer the preparation time, the greater the production of masses, because the machine should use any mold at least as much as the preparation time, so the productivity is high and the labor costs are low. For this reason, the work without stocks (the parts can be produced when desired) becomes impossible. With the SMED method developed by Shigeo Shingo, the preparation time can be reduced to one minute regardless of the machine [19].

1.3.3.3 Poka – Yoke (Error Prevention Apparatus)

Poka-yoke aims to achieve zero faulty production without requiring more control elements against human factors such as forgetfulness, carelessness, misunderstanding, lack of concentration, lack of standards, inexperience, vacancy, sabotage, etc. It does this protection by using a variety of error-avoiding and auxiliary tools and strategies. For this purpose, it may add additional mechanisms to the user machine and/or design changes on the product [19].

1.3.3.4 JIDOKA

Someone who works according to Jidoka technique can stop production if he feels that the process produces faulty parts. The power to stop the line is no longer given to technicians with the developing technology. A machine that automatically detects an error in the part with sensors can also stop the line. Under this technique's philosophy, it is more accurate not to produce anything than to produce faulty parts [9].

1.3.3.5 Just in Time (JIT) Production System

The main idea of a just in a time production system is to minimize costs by preventing waste. This can only be achieved by producing the required amount of required parts only at the required quality level at the required time and place.

JIT is the system in which each party in a production line is produced as quickly as needed by the stage (manufacturing department) following this production line. With this system, almost no stock is provided. Ideally, the JIT system is to work without stocks. As much as needed material, minimum stock production system and zero stock production system are the concepts that express JIT approach [20].

1.3.3.6 HEIJUNKA (Leveling)

The primary and most important function of leveling is to ensure that production can be easily adapted to demand changes without the need for the finished product being processed or in progress. Also, installing more than one model or product on the same line reduces the total number of lines required and therefore the total factory area. A third function of the leveling is to save the products from the necessity of providing unnecessary stockpiles by allowing the customers to be dispatched immediately after the desired order composition has been reached. It is the amount and combination of customer demand from dealers, which determines what the leveling scheme will be [9].

1.3.3.7 Total Productive Maintenance (TPM)

Total productive maintenance aims to extend the life of the equipment, to keep the factory and equipment under optimum conditions for production or service, to increase the return on investments, to increase the ability to deal with emergencies and to ensure security.

Through total productive maintenance, total equipment efficiency is increased, global plant efficiency is maximized, maintenance systems are installed throughout the entire life cycle of machinery/equipment, process scrap rates, machine, and line stops, machine failures, work accidents are reduced [21].

1.3.3.8 KAIZEN

Lean production which is not fed by stock, which is extremely sensitive in this matter, is not a stable system that is satisfied with the point it has reached, despite the “best practice” position that it has reached today. On the contrary, it is a prerequisite for the continuity of the system to be further empowered, to determine all the time losses and waste and to take necessary measures. For this reason, continuous and regular works are carried out in companies that have taken lean manufacturing at every moment, at every stage, for further improvement of production, and this dynamic improvement approach spread over the whole system is called KAIZEN. One of the most important features in KAIZEN application in lean manufacturing is the participation of workers in the understanding of KAIZEN improvement works in team work. Lean production is a system that respects the creative potential of all employees and in KAIZEN, this potential is channeled into potential production using “Quality Circles” [22].

1.3.3.9 One Piece Stream (KANBAN, Pull System)

The purpose of lean production is to produce all the parts of the products that will be out of line daily, in principle, all the production units can be worked with the smallest possible lots according to kanban and regularity in production rule. As predicted, this depends on some preconditions. First of all, productivity is very high, production times are very short, in the production flow, both workers and finished and processed parts should not lose any time "waiting". The "waiting" of the parts being processed means that the work on a station is not immediately passed from the processing stage to the next one, in stockworks, jobs go by that way. However, machines in lean manufacturing are placed according to "process-based layout" or "process-based lines". The flow of parts between processes one by one without waiting is called "one-piece flow". The one-piece flow can be defined as the "reset" of the line/machine by reducing the process/machine transfer lot to one, which means the stock level becomes zero [23].

1.3.4 Lean Production in Turkey

Lean approach has known in Turkey since 1990s and application examples are increasing. Previously, practices emerged as the use of independent techniques, then

became an increasingly integrated system approach. With the impact of economic crises and opening to export markets, companies feel more and more obliged to change their current way of doing business. Lean Production has been a course program of universities since 1992 and has been the subject of doctoral and master theses.

The automotive sector in Turkey seems to be more active in Lean System implementation. The best answer to the tendency of lean applications to connect to cultural factors is the fact that in the Toyota automobile plant in Adapazarı, Turkish workers have quickly reached the productivity level of Toyota Japanese workers in Japan and they have been the first to be the first among all Toyota factories in the last few years. The other major manufacturers Ford, Renault, Bosch, Tofaş Production System, and Hugo BOSS have started their lean manufacturing activities both in their enterprises and in the subsidiary industry.

Although lean applications have provided significant cost savings in individual firms, these firms have not achieved the full potential savings and the impact on the whole country has not been high enough. Conducted by the McKinsey Global Institute "Implementation of Turkey Breakthrough Productivity and Growth" according to the findings of the survey, non-farm labor productivity in Turkey is about 40% of the US economy. Even in modern firms that are 2.5 times more productive than traditional firms, current labor productivity is 62% compared to the best in the sector. It can easily be increased to 95% with improvements that can be made within the current conditions of the country. Considering the strong correlation between labor productivity and per capita, Gross Domestic Product (GDP), GDP per capita doubled in 2015, with a potential %30 increase in employment seems to be possible.

When the difference between the current yield and the potential yield levels is analyzed, it is seen that the most important share is in the areas where the Lean Manufacturing techniques such as management techniques, capacity utilization and relations with suppliers and product structure can provide serious improvements.

In our country where the capital is limited and the cost is high, the efficiency of the growth must be increased. The Lean Approach illustrates ways to use resources that are consumed due to wastage. When saved resources are directed to create more

value, both the existing markets can have wider economic opportunities and new markets can grow.

1.3.5 Lean Thinking and Human Resources

Lean thinking is based on the human-centered system. Process improvements are continuous improvements with the participation of everyone in the company. These improvements are not in the form of staff reduction but in the form of changing the job descriptions of the personnel here as the inefficient jobs decrease. However, if a staff should be reduced, what mechanisms should be established for them. Because lean thinking is based on the foundations of the people to look like human beings, to show intimate interest like human beings and to give a human-like value.

Personnel selection should be preferred for those who have a high level of education, are open to development and innovation, and who are aiming to improve themselves and their job. We can use self-assessment, employee surveys, recommendations, and complaints when improving processes. Here, self-evaluation is the determination of new targets according to the extent to which the targets set by the employees are realized. With the suggestion system, the ideas of the employees are taken and the appropriate ones are put into practice. The owner of the ideas brought to life can be encouraged by giving a reward.

Besides, the company will start to work in the orientation (the institution is introduced, the work is introduced and the necessary training is given) a common point is created.

1.4 Literature Review

1.4.1 Lean Manufacturing Literature Review

This section provides an overview of the research article and research contribution in international journals, an overview of the research methodology and the type of industry in which lean thinking is applied. Since the 1980s, many businesses in various sectors are constantly developing programs to improve efficiency and quality. Many authors argue that "lean production" can be implemented as the best possible production system and in any industry and in any process [24–26]. Based on research conducted by different researchers in different sectors of production, the

lean approach has yielded very successful results in the various industrial sector [26–29].

There are many studies on lean production in the literature [30]. Some of the highlights of these studies will be presented to readers in this section. Apart from these, although there are many more valuable studies, unfortunately, it is not possible to take all.

First of all, “The Machine That Changes The World” takes an important place in lean manufacturing literature [31]. Also, the researchers made various evaluations of Lean Manufacturing literature. Hines et al. (2004) have reviewed the development of lean production, and researchers have argued that it is important to consider lean thinking at the strategic and operational levels to understand simplicity as a whole [32]. It is accepted by everyone that it is beneficial to be lean. Some researchers focus on Lean Manufacturing's limitations. Cooney (2002) claimed that mass production still has a permanent value from the perspective of the business design and manufacturing process [33]. Bhasin and Burcher (2006) demonstrated that lean practice or lean transformation is still facing problems and the underlying reasons for failure, along with low-level success [34]. Shah and Ward (2003) identified 22 elements required for lean application and classified them into four packages (category): JIT, total productive maintenance (TPM), TQM and Human Resources Management (HRM) [35]. Moyano-Fuentes and Sacristan-Diaz (2012) reviewed the literature on lean production and categorized the literature in four areas according to the value chain of internal aspects (workshop), business organization and the effect of geographical location [36].

In the following section, studies on lean manufacturing based on systematic literature review were examined together with the authors.

Salem et al. (2016) has made efforts to know the awareness of Lean awareness and Lean benefits and the perceptions of lean struggles in different industrial sectors in Qatar about the level of recognition of simple concepts, principles, tools, and techniques [37]. The data were collected from 333 organizations from different sectors such as oil and gas, academic institutions and service sectors through an on-line survey. The results showed that the industry in Qatar should have a greater reputation for lean thinking to strategically advance the existing activities and to

cope with global competition. The research also shows that there are differences in the awareness, recognition and appreciation levels of the lean concept in different industrial sectors.

Chaple (2014) explored the principles of Lean manufacturing in Indian manufacturing industries and barriers to the implementation of Lean propagation and the existing factors [38]. The results show that the focus is on the analysis of lean manufacturing trends for research. Simplicity focuses on answering specific questions from different levels of managers responsible for lean implementation to assess the lean implementation level and to verify expenditure on lean implementation. He has worked on a multi-criteria decision making (MCDM) to evaluate the overall Lean performance and the popularity of Lean in India. In practice, Chikhalikar (2015) focused on lean application in the engine production unit in India [39]. In research, it has determined the importance of Lean tools and time understanding to implement it. Research has shown that the following factors are effective on waste 7 in a lean application; these are lack of information transmission, inappropriate inventory management, bottleneck operation, material flow, and transportation problem, JIT, Kanban, Kaizen, TPM, 6 sigma, 5S, Mold Change in Single Minutes. Kumar and Kumar (2015) conducted a study to demonstrate the importance of Lean Manufacturing elements related to the Indian manufacturing industry [40]. The study also lists the benefits gained and the major barriers encountered and identifies the opposite effects on cost reduction and identifies the negative impacts on issues such as physical and mental health, society, and product quality. Chowdhury (2015) conducted a study to improve the efficiency of the furniture manufacturing industry in India [41]. Several simple strategies such as Mold Change in Single Minutes (SMED), Gemba (Real Location) and Short Range Control have been applied. The results showed that both the monetary conditions and the different batches yielded a significant improvement in the reduction of processing times. Also, the study shows that the effectiveness of General Equipment increased at higher multi-factor efficiency of 2.26. Through this study, it has been understood that lean strategies can be applied successfully in the furniture manufacturing industry.

Çil and Türkan (2013) present a model that focuses on the prioritization and relative weights for each element of lean transformation, clearly taking into account the

relationships between the components of institutional transformation related to the evaluation of the lean transformation process [42]. Therefore, this study tries to quantify these relations. For a structured review of the relationships between the elements, a model that provides a holistic view of the lean transformation process is proposed. An ANP-based modeling approach for determining the weights of lean transformation determinants is presented. Thus, highly qualitative relationships between lean transformation components can be clearly stated. An analytical network process modeling approach is used within the proposed framework to determine relative significance weights for each item in the model. This application of lean enterprise transformation methodology proposed, for example, the incident is presented in an enterprise engaged in production in Turkey.

Larteb et al. (2015) found that the success parameters of Lean implementation are top management participation, commitment, time and resource allocation for development projects, strong management leadership and employee development program [43]. Building surveys were used in the study and included seven parameters of the lean application. These parameters are personalized diplomatic initiative, senior management obligation, resource allocation, strong communication, structural methodology, multifunctional teams, and continuous performance measurement.

Verma et al. (2017) conducted a study to identify waste-related problems such as equipment shortage, bottleneck problems, and to correct errors in lean manufacturing applications in small-scale industries [44]. The aim was to eliminate rejection control, inventory control time, waiting time, installation time and additional times or activities. In this study, new machines were not purchased and operators were not expected to work faster or more; only procedures and layouts have been modified to ensure that the product flows more smoothly in the production process.

Norani et al. (2010), the main reason for the failure of lean manufacturing application, a lean production transformation, organizational change management process during the process of change in the management of the change has been determined [45]. This study provides a basis for further experimental research and verification. It enables practitioners to better understand lean principles, tools or lean production to minimize resistance and contradictions in implementing a lean

manufacturing system. In the present study, eleven critical factors have been examined and the proposed structure of organizational change is intended to provide practitioners with clear guidance for minimizing resistance and debate for better understanding and lean implementation and thus to improve chances of success. Karim et al. (2013) conducted a study on developing an effective method for implementing lean manufacturing strategies [46]. They used the methods of production and process details, Lean teamwork and performance variables for their studies. They combined Value Stream Mapping (VSM) and Method Time Measurement (MTM) and proposed a new approach to reduce lead time and measure productivity based on the Lean principle and standard processes. Cil (1997) examined the relationships between production strategies and production technologies options and configurations and proposed a model for this purpose [47]. Hodge et al. (2011), conducted a study to identify lean tools in the textile industries to eliminate customer wasted and non-value-added activities in the US to increase customer satisfaction [48]. The authors described that the following obstacles to the implementation of lean manufacturing were resistant to changing both workshop workers and management; store employees are reluctant to offer suggestions for improvement; a disconnect between marketing, sales, product, and development; store staff are non-native speakers; Education should, therefore, be multilingual. Storch et al. (1999), assumes that lean ship production requires an uninterrupted and smooth process flow, and building strategies that reflect block fragmentation should be developed and followed, even if the design suitability is expensive [49]. Includes integration and balance between body, team and painting work; facilitating continuous and uniform workflows within production levels; Maximum use of group technology advantages. Three metrics are recommended for monitoring the lean process flows in shipbuilding. These are the amount of work accumulated between the process steps (WIP); leveling factor index and business volume.

Obeidat et al. (2014) research indicates that five types of waste are identified and analyzed with VSM in the V436 sewing line; These are defects, inventory, over-production, shipping and standby time [50]. Lean manufacturing techniques applied mean line balancing, layout redesign, and quality at the source. The effects of applied lean techniques on production are analyzed and an improved future-state value flow map is developed. The results show a reduction of 43% in flow time as well as a

reduction of about 96% in production waste. Process measures must be defined here and processing costs must be quantified. Line productivity is based on the number of line workers and the product cycle time. To increase the productivity of the workers, the line target, workstation target, and work efficiency will be calculated separately. It calculates the cost per hour. The line balancing concept is the test for each line and the layout will be redesigned.

According to the current literature, it has been concluded that there are some lean tools such as Standard work/cycle time reduction, Kanban, continuous flow/cell design, VSM, TPM / TPS, JIT, Kaizen, SMED, Poke Yoke. Visual Management / Control is the most common lean tool in various sectors. From the present literature, some of the barriers to the implementation of lean instruments appear to be Management's Participation, Employee involvement, communication, lack of training, cultural problems, experience, budget, fear of failure, conflicts, and misuse of workers' potential capacity.

Ahlstrom (1998) investigated whether there is a sequence of applications in lean manufacturing such as Im and Lee [51]. In his article, Ahlstrom sought answers to this question and worked for a company that applied lean manufacturing for two and a half years. As a result of the study, it was found that there are various rankings in the application of the principles of lean manufacturing.

Satoğlu and Durmuşoğlu (2003), 17 SMEs have observed the formation of lean techniques in the factory level which operate in Turkey [52]. When the subjects examined under the Production Management were examined, the subject with the lowest maturity level was the supplier relationship management, while the subject with the lowest level of lean maturity was the Kanban system by far. Because production was seen pushing their production company in Turkey which can not be given up. Considering the issues examined under Strategic Management, it was observed that lean maturity levels were more balanced.

Bamber and Dale (2000) conducted a study on the application of lean manufacturing methods for an organization operating in the aviation sector and producing traditional production [53]. In the study, the approach to the event was approached in terms of various techniques, and it was stated that there would be an additional difficulty with Kanban.

Thirty studies related to lean manufacturing in Turkey are examined. The studies are presented in Table 1.1.

Table 1.1 Lean manufacturing literature

Author	Year	Method	Application Area/Sector
Sevimli [54]	2005	General Principles & Techniques	Automotive
Ersoy [55]	2007	SMED	Manufacturing (Metal Sector)
Arslan [56]	2008	General Principles & Techniques - REFA	Automotive
Ertürk ve Özçelik [57]	2008	Value Stream Costing	Cost Management, Cost Analysis
Aydın [58]	2009	Value Stream Mapping	Automotive
Demir [59]	2009	Total Productive Maintenance, SMED	Arçelik A.Ş. Washing Machine Fac.
Kazıcıoğlu [60]	2009	General Principles & Techniques	Manufacturing (Tire Factory)
Tekerci [61]	2009	General Principles & Techniques	Manufacturing
Taşçı [62]	2010	General Principles & Techniques	General
Daşçı [63]	2010	Simulation	Furniture
Türkan [64]	2010	General Principles & Techniques	General
Tanık [65]	2010	6 Sigma, SMED	Automotive
Terzi ve Atmaca [66]	2011	Value Stream Costing	General
Çobanoğlu [67]	2011	General Principles & Techniques	Automotive
Özfındık [68]	2011	General Principles & Techniques	Food
Meriç [69]	2011	ERP and Lean Manufacturing Techniques	General
Şengül [70]	2011	5S, Value Stream	Manufacturing
Hülagü [71]	2011	SMED	Manufacturing
Özveri ve Çakır [72]	2012	6 Sigma	Rim Manufacturing Factory
Kaymakçı [73]	2012	5S	Service
Küçükuysal [74]	2012	General Principles & Techniques - ERP	Automotive
Bulut [75]	2012	General Principles & Techniques - ERP	Automotive and Manufacturing
Özçelik [76]	2013	Value Stream Costing	General
Aksu [77]	2013	General Principles & Techniques	Automotive
Aktaş [78]	2013	Value Stream Costing	General
Bırakmaz [79]	2013	General Principles &	16 Different plants

		Techniques	
Berber [80]	2013	General Principles & Techniques	Manufacturing
Uçan [81]	2014	General Principles & Techniques	Automotive Suppliers
Ergüneş [82]	2014	Value Stream Mapping	Manufacturing
Bilget [83]	2015	Simulation	Textile

According to the studies, it is seen that the lean manufacturing system is applied in other manufacturing and service sectors as well as in the automotive and automotive sub-industry sectors. Besides, there are many methods used in lean production when an evaluation is made on the subject in the literature. While one or two of these methods were examined in detail in the studies, it was observed that many of them were examined in a single study. In this category, which is described as "General Principles and Techniques", there are some just-in-time production, kanban, 5S, smed, kaizen, total productive maintenance, cellular manufacturing, poka-yoke, hoshin-kanri, heijunka, shojinka, value flow mapping. It was observed that there was no study dealing with the application of any lean production tool with job analysis methods.

1.4.2 Job Evaluation Literature Review

1.4.2.1 Job Evaluation in World

Job evaluation was developed in the USA for the first time in the world. It is possible to examine this historical development in three stages. These steps can be examined in the following order [84].

I. First Developments Before the First World War

II. The Period Between Two World Wars

III. The Second World War and After

I. First Developments Before the First World War

It is thought that, in America, Frederick W. Taylor started his work evaluation with time and motion studies. The first work was carried out by E. O. Griffenhagen in 1909 in the city of Chicago on municipal services. In 1912, Griffenhagen joined the Common-Wealth Edison Company, one of the first industrial applications of job evaluation. In 1914, white-collar workers were classified by Harry E. Hapf in banks and insurance companies. In a study conducted in 1916, it was determined that there were other purposes other than determining the wage between the aims of the job appraisal studies [85]. These objectives can be listed as follows:

- Selection of new employees
- Transport and upgrade (promotion)
- Coordination
- Providing health and safety
- Placement of disabled employees
- Establishing and developing employee-employer relations.

Previously only mixed job descriptions were written with random notes, then common items were clustered, and checklists were prepared for the registration of information matching this type of processing. Thus, previously received random notes have been transformed into complete records.

II. The Period Between Two World Wars

In the early times, time, motion studies, work analysis, job descriptions were dealt with, and work analysis was not given enough importance in determining the value of the work. The determination of fair wages was also given importance during the First World War. The difficulties of providing employees, the difficulty of training the employee and the necessity of the employee, the problems arising from the war, increased the managerial interest in personnel management. Meanwhile, the valuation of jobs in the determination of fair wages started to attract a little interest [86].

Up to 1926, four methods have been developed for job evaluation. In the early times, the relative difficulties of the work or the method of ordering according to the values of the enterprise were used. Then, the "Rating" or "Classification" method which was

created in Carnagie Technology Institute's Personnel Survey Office and implemented in 1922 in six or seven enterprises was used. Later in 1925, Merrill R. Lott put the job into small sections and introduced the “Point Method”, which is based on the determination of the score value for each section. In this method, the work is divided into small sections and each section has determined a point value. Eugene J. Benge tried to implement the point method in Rapid Transit Company in Philadelphia. In 1926, however, they developed a new method called “Factor Comparison Method” because they needed to emphasize some factors in their measurements. In “Factor Comparison Method” wage values are defined for each factor (but in “Point Method” score values are defined for each factor), then key jobs are selected and these key jobs are ranked according to factors so wage values of jobs are defined by this way, then other jobs’ values are ranked according to key jobs. All of these methods are known as "Job Evaluation" [86].

III. The Second World War and After

The existence of an organization with a very regular classification of every work such as the War Labor Board - WLB during the Second World War, and the development and use of the experiences gained in the next war in the Korean War was an important step for the establishment of the job evaluation. Afterward, the permission of the Wage Stabilization Board was deemed necessary in the regulation of wages of the enterprises, so the developments related to wages were audited.

During the Second World War, work evaluations were carried out in England for the first time, then in 1948 in France and 1951 in West Germany and Sweden [87].

1.4.2.2 Job Evaluation in Turkey

In our country, job evaluation studies, began in 1948 on the Karabük Iron and Steel Works then Mechanical and Chemical Industry Corporation (1952), Turkish State Railways (1955-1963), Turkish Petroleum Corporation (1964), Turkey Pulp and Paper Mills - SEKA (1964), Sümerbank (1966) was put into practice in public institutions. After 1960, it started to be implemented in some private sector organizations [84].

In 1961, by the interagency commission established in the Ministry of Labor; To ensure uniformity in wages in the public sector, it was decided to implement a job

evaluation system and to establish a joint authority to monitor the implementation of such activities [87].

In the First Five-Year Development Plan, the principles that promote the productivity of the workers are used to benefit from modern organizational methods and work inspection techniques.

The interest in the job evaluation for the implementation of scientific methods and techniques in business life has gradually increased and the importance of the issue has been emphasized in the prepared development plans and measures have been introduced. At the workplace level, job evaluation has gradually increased over the years in the industrial enterprises which have a large employment and production capacity. The biggest example of these studies at the level of the line of work is the study of Metal Industry Job Classification Studies. Metal Industry business classification studies have opened the way for such activities in other industries.

In job evaluation studies, instead of "Establishment Level", the "Business Line Level" was first started in the metal branch of the Metal Industrialists Union (MESS). In 1981, a "Job Grouping System" is prepared according to point method that structurally includes also a factor comparison system, by 29 establishments in Metal Work Line for determining a "Wage Rise Scale". These plans are accepted by "High Board of Arbitration" and entered into force on September 1, 1982, as a collective bargaining agreement. The work on the plan was continued and the number of sample works was increased to 320 after one year, and the work grouping based on the work grouping in 1984 and 1986 was carried out with the contributions of the Employer and Labor Unions [87].

The job evaluation studies in the chemical, plastic and tire sectors started in 1984 and the KIPLAS Work Grouping Plan was prepared and put into practice. This plan covers over 500 sample works.

The textile business was started in 1985 and in 1986, the Textile Work Line Business Grouping system was defined. The system covers over 500 sample works.

Job evaluation activities were carried out between 1985-1987 at the National Productivity Center of the Food Industry Business.

Today, the work of many organizations on the subject of business valuation continues and the completed works are put into practice.

1.4.2.3 Previous Application Studies

Turkey Metal Industrialists' Union (MESS) (1981), carried out a study in the metal sector within the framework of university-industry cooperation, 395 job titles are evaluated in the scope of that study by using the point method. The arithmetic sequence method is used to determine factor grade scores. In this study, it was taken as a reference in many job evaluation study carried out in Turkey. This study was taken as a reference in many job evaluation study carried out in Turkey.

Gemalmaz (2000) presented the definition of factor and degree which constitute the most important part of the Point Method [88]. Kılıç (1990), has made an application work using the Point Method, in General Directorate of Agricultural Enterprises (TİGEM) [89]. In this study, the weighting of the points was made by considering the opinion of the business managers. Each factor has detected 5 degrees. In this study, the weighting of the points was made by considering the opinion of the business managers. 5 degrees are set for each factor. With the results of the job evaluation, the jobs are grouped and the wages of each workgroup are allocated by using the linear wage curve. It has determined the slope of the wage curve in the direction of the business managers without using any mathematical model.

Özen (1992) compared two methods using the Point Method from the analytical business valuation methods and the Ranking Method from non-analytical business valuation methods in a company in the automotive supply industry sector. The weighting of factor and factor degrees was made by taking into account similar operations, job lines, and industry plans. In this study, job evaluation results and wages are not associated.

Bingöl (1993) compared job evaluation systems in a total of 124 organizations, 75 of which were public and 49 of which were private sector organizations. In this study that firms' factors and factor degree weightings are compared according to Point Method [90].

Çubukçu (1993) examined the historical development of job evaluation studies in private sector cement workplaces and the effect of this development on wages [91].

Dincer (1994), compared the factors and degree points used in job evaluation studies in business in Turkey. Besides, he presented prevalence levels of job evaluation practices in private and public institutions, the problems encountered in practice, the approaches of the workers and employers to the job evaluation practices in the business life [92].

Güceğlioğlu (1994) used the Point Method in a small scale textile business. It is based on the study of MESS (Metal Industrialists Union) in determining and weighting factor and factor degree number [93].

Özbalaban (1998), used in the construction machinery industry Point Method. In the determination of factors and weighting of factors, reference was made to the study of the Turkish Metal Industrialists Union. In the study, the data obtained as a result of job evaluation have drawn a new wage curve considering the wages given in the company and in the market. He took into account the points obtained from the job evaluation and calculated the basic wage that each job should take over the new wage curve [94].

Atalay (2000) has determined lower and higher wages for each workgroup by considering the points obtained as a result of the job evaluation and then developed a compensation system including the performance evaluation of the employees. Borland 4.0 Client / Server has developed these systematics into software using the programming language [95].

Öztürk (2001) used the Point Method in his application study in the electricity industry. In this study, 57 titles have been included in the scope of job evaluation. Considering the results of the job evaluation, he developed two separate wage-setting systems. It obtained linear and parabolic charge curves using the least-squares method [96].

The personnel working in the production environment expect to receive satisfactory wages in return for their effort. Wage is an important factor in the motivation and efficiency of the employees, especially in the labor-intensive sectors. On the other hand, employers sometimes refrain from giving satisfactory wages to their employees because they are unsure whether they will have continuity of employee performance or sometimes due to market conditions.

The lack of a system that meets the demands and expectations of employees and employers in a balanced way causes some troubles among the two sides. Even so; these troubles sometimes run until the employees slow down or stop work. This results in loss of productivity, production, cost, and prestige for the enterprises. The need for a wage system that meets and balances these expectations of each side becomes an important requirement, especially in the labor-intensive sectors and in the enterprises with a large number of employees.

In this study, the 5S tool of lean manufacturing is used for the success factor while defining the wages of employees which were defined by using the job evaluation point method in a heavy machine production factory. There are many application studies about various tools of lean manufacturing. And also there are many application studies of job evaluation methods. But there aren't seen any studies that combine both of these courses of management science in the literature.

The reason for the application of this method is to ensure quietness and peace in the enterprise by solving the conflicts between the worker and the employer most subjectively and systematically possible. In this way, the efficiency, prestige, and production of the enterprise would be increased and the costs would be reduced. If this method could be applied to all large and medium-sized enterprises in Turkey, it can also be provided to increase the labor productivity of Turkey.

CHAPTER 2

MATERIAL AND METHODOLOGY

Productivity is a certain issue for manufacturing firms in today's market conditions. So, productivity and performance should be increased. But in many businesses increasing these information values being complex problems to be solved. In this study, we evaluated one of these businesses and applied work analysis and lean manufacturing tools. This business is the manufacturing area of Çiltuğ Heat Industry and Trade Incorporation.

This company had also a problem with low productivity and performance rates. Where completed projects' man-hour/ton rates were more than bidding values which are required to be the target of the production department. And also they had faced with work slowing or stopping actions of workers because of wage increment dissatisfactions related to injustice between workers or convenience with promised levels. Besides, there were unhealthy, dirty and untidy work environment and low occupational safety preventions.

To cope with these problems firstly 5S tools started to be applied. For this, balanced 5S teams are established according to the ability and experience of workers. In conjunction with this, KAIZEN educations are given to workers and they are started to be given targets for these actions. At the end of each month, all related targets are evaluated and 5S team points are calculated. Then, work analysis, evaluation studies are performed by management. As a result of these studies, wage assignments are defined and they are increased at the rate of 5S team point for every worker.

In this part, firstly 5S application method is explained which was used as a performance evaluation tool. And also KAIZEN tool of lean manufacturing is stated as a used form in this study. After an explanation of used lean tools, work analysis, evaluation, work point calculations, salary system applications are disclosed respectively. Finally, the wage increment method is given according to 5S team

points. In the last part of this part introduction of the material resource firm, Çiltuğ will be introduced. The application steps of this study are shown in Figure 2.1 in summary.

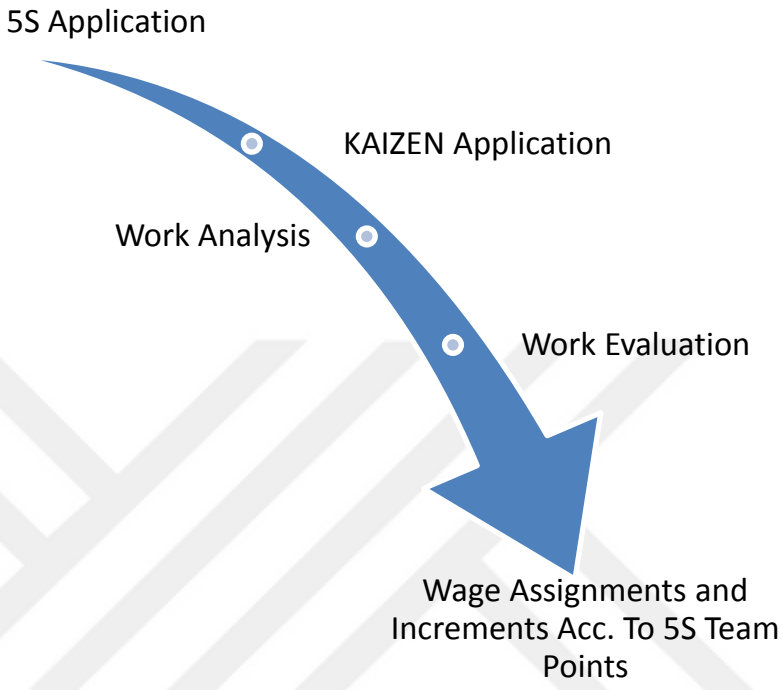

Figure 2.1 Application steps of this study.

2.1 Performance Evaluation With Lean Manufacturing 5S Method

Lean Manufacturing is the whole of concepts, systems, and techniques that aim to simplify the process of creating products and services from waste, to perfect the values presented and to increase the profitability of the company in this way. A waste in lean thinking is anything that does not create value for the customer beyond what is known, and that the customer does not accept to pay extra. In today's competitive environment, the trend is to respond quickly to customer demand and deliver high-quality, low-priced products. To be a global company, it must be the goal of all managers to remove wasted resources and achieve an effective workflow. This is exactly what the lean production philosophy tries to achieve. Our working environments tend to be irregular and untidy at all times, due to the dynamic nature of their existence. One of the basic tools of providing this arrangement and order in the workplace is the 5S applications. The main purpose of 5S applications is not to

polish the external appearance of the company but to make the best use of materials, equipment, and workforce by increasing productivity within the company. 5S is a valuable tool that can be appealed by every manufacturer. The application model of 5S is shown in Figure 2.2.

In this part of the study, a 5S study was carried out within the lean manufacturing project to meet customer expectations and reduce waste in Çiltuğ Heat Ind. and Trade Co., which is one of the biggest companies in heavy machinery manufacturing sector in Turkey. This application concern Çiltuğ and occurred between 2014 and 2016 and we presented the last 1 year results of this study. Çiltuğ intended reducing costs and implement a continuous improvement culture, which triggered the need for process innovation. Although a simple system, implementation in practice may not be an easy task, given that its success highly depends on acceptance from employees, modification of their habits and attitudes, and involvement and commitment of the top management [97]. Since Çiltuğ's production is a project-based on job shop style, it is not possible to measure the productivity change before and after 5S because the same job is not done continuously and this causes a lot of job diversity. Successful application of 5S may provide the following advantages [98–100]: workplaces more efficient, organized, clean, productive and safe; improvement of working conditions and values of the employees; better view of the problems; embodiment of daily activities by employees; increased productivity, flexibility, quality, safety and motivation of employees; reduction of costs, unproductive time, space and movements; and reduction of losses related with failures and breaks.

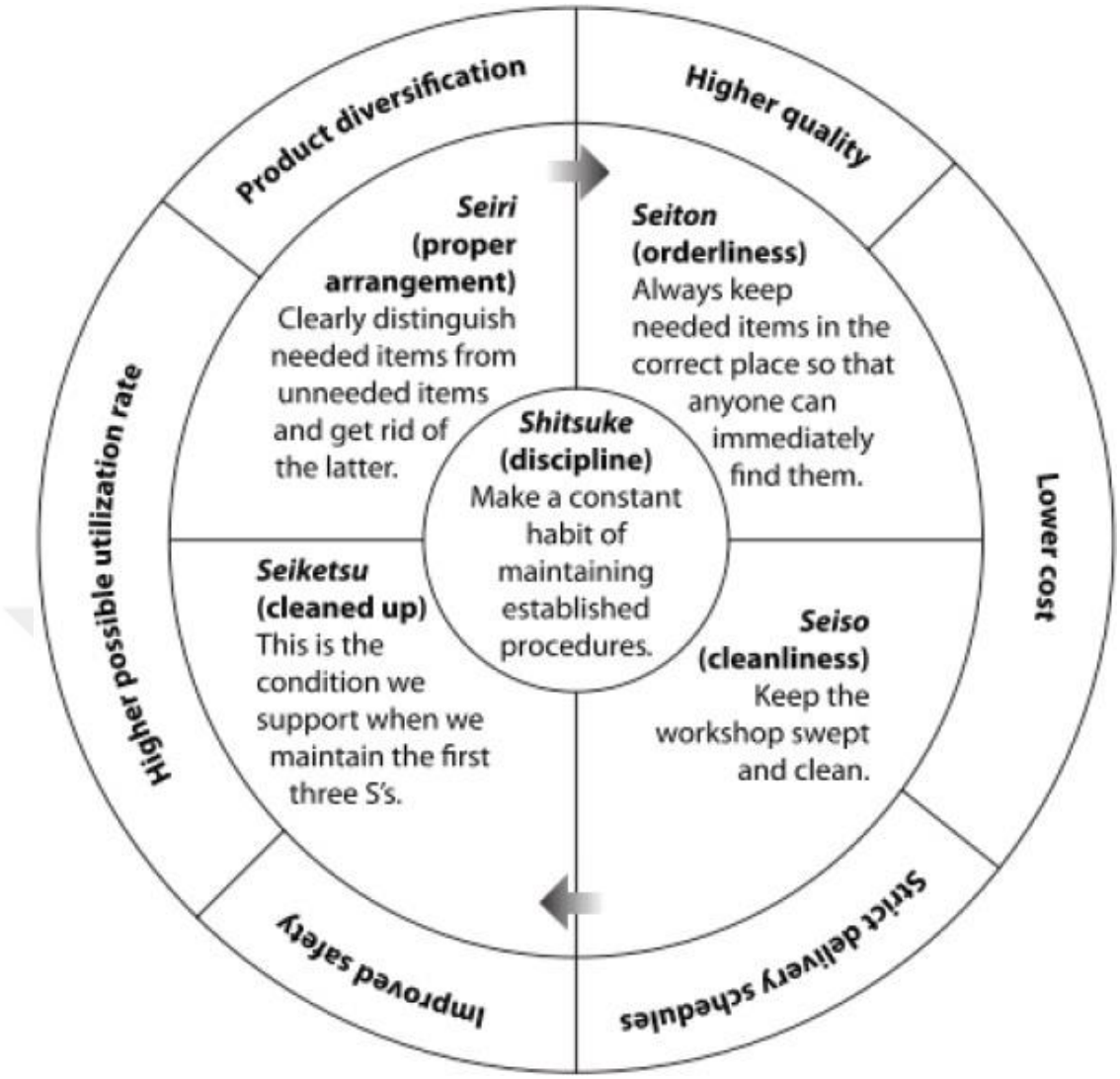

Figure 2.2 Model of 5S study-overview of the 5S steps [101].

2.1.1 Constitution of Teams

Team leader candidates (TLA) are suggested by factory management and human resources responsible had an interview with these candidates. After the final acceptance of these team leader candidates (TLA), the teams are composed of these TLAs. Each team limited between 3-10 workers. But because some operations are interwoven to each other some of the team numbers are increased 1 or 2 workers more than 10. A working area defined for each team and they had the responsibility of tidiness, cleanliness, ergonomics, and 5S related subjects of that area.

2.1.2 Application of Pilot Region

During the meeting with the management, it was decided to identify the problems by applying a pilot application against the risk of missing details in the application, then correct the defects if any, and apply them to the whole factory. Thus, the risk of major disruptions to occur in the whole enterprise was prevented. The 5S was extended to all production units of the company after pilot region selection and experience in this region. For pilot region selection, short duration of the application, and experienced workers were the criterion. So cut shear and punching machine areas were selected as a pilot region where has a dimension of 25 m x 50 m which was also including their raw material and semi-product stock areas. But all workers in these areas became one team so that they would be responsible for all that area as together. All applications are tested in that region and some corrections are done in the format of 5S evaluation checklists, suggestion forms, and cleaning plans.

To ensure continuity and discipline, all employees are trained in 5S and increased awareness of the issue. The performance is based on a 10-question 100-point 5S audit form, and regular audits and constantly monitored departments strive to bring the 5S score to an ideal level of 100 points in line with the targets given to them after the first audit. These steps are summarized in Figure 2.3.

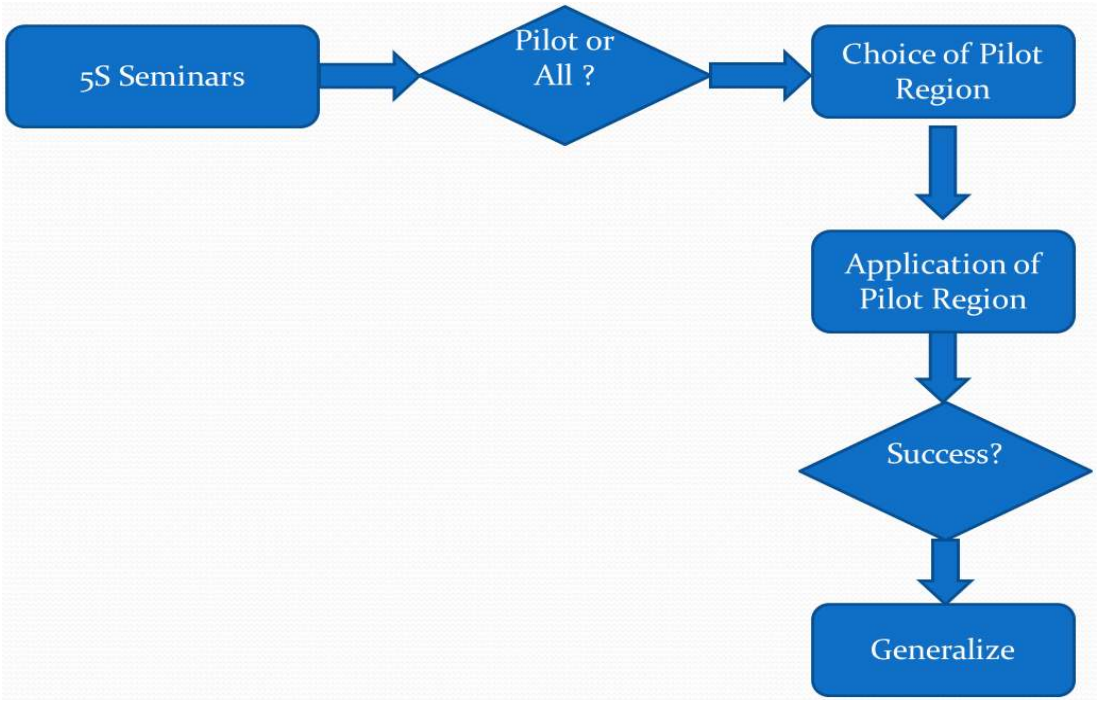

Figure 2.3 Preperation steps of 5S method before generalization

2.1.3 5S Implementation

2.1.3.1 Sorting

Firstly, a detailed analysis was made on each of the workstations, evaluating the organization of equipment and which tools and documents were needed to perform the most common operations. These issues were affecting productivity and were causing serious health risks in some cases. Firstly, 5S tags are used to recognize the separation of required ones from unnecessary ones. Error tags are labels to indicate what product considered to be sorted, by which reason they are sorted, and what the result of the sorting action is. Binding and removal authorities of error tags vary organizationally (See Table 2.1). When the criterion for sorting is changed according to the value of the material to be extracted; what to do with the pasted object is defined with similar criteria. In this scope, red labels were used for the removal of materials not to be used in the working area during the sorting phase and for determining and tracing what to do (see Figure 2.4). And, yellow labels were used to identify the materials and equipment that will not be removed from the area during the sorting phase but need to be repaired, renovated or revised (See Figure 2.5). Figure 2.6 represents before-and-after pictures of sort implementation.

Table 2.1 Error tagged materials removing authorization table

Value of Material	Authorization for Removing Tagged Material
Between 0 € - 100 €	Team Member (Worker)
Between 100 € - 1000 €	Expert - Supervisor
1000 € and more	Manager

Classification (Sorting)	1-Raw Material 2-Semi Product 3-Material 4-Finished Product	5-Machine/Equipment 6- Die 7-Tool/Fixture 8-Other	
Object Name			
Object No			
Amount/Value	Amount:	Value:	Total:
Reason	1- Not Required 2- Scrap 3- Not Urgent	4- Waste Material 5- Unknown 6- Other	
Responsible Department			
Action to Do	1- Close Out 2- Use (Send Back) 3- Put Sorting Area 4- Store Seperately 5- Other	Dispatched by (Signature)	
Date	Label Date .../.../.....	Dispatch Date .../.../.....	
Red Label No:			

Figure 2.4 Red labels

Date:
Action:

Responsible Person:
Completed Date:

Figure 2.5 Yellow labels

BEFORE	AFTER
The unnecessary materials, the machines left in front of the warehouse door, the staircase of the foreman office on the warehouse, were causing irregularity and health risks.	As a result of the work done, the machines were divided into machine park, the unnecessary materials were removed from the warehouse. The stairs are painted to make the factory more orderly and safe.
	

Figure 2.6 Implementation of sorting

2.1.3.2 Set in Order Implementation

Objectives of the set in order step are a smooth-looking workplace, efficient planning and placement, increasing productivity by saving time lost by searching for materials, storage based on wh questions. After the evaluation of the current status of the shop floor, an evaluation checklist was produced for each workstation with the main issues requiring addressing in each of the 5S steps. In a brainstorm session with the team, the evaluation checklist was analyzed and corrective measures were proposed to solve the issues which are seen in Table 2.3. Figure 2.7 represents before-and-after pictures of sort implementation.

BEFORE	AFTER
It has been determined that the irregularity in the warehouse and the use of the shelves used were inadequate.	New material boxes were provided, shelves were renovated and tagged.
	

Figure 2.7 Set in order implementation

2.1.3.3 Shine Implementation

The purpose of cleaning is to remove waste, dirt and foreign matter for a cleaner working environment. Cleanliness was also a problem, being noticed the lack of inspection norms in the workspaces and general dirtiness of some storage places, parts and of the floor. While teams are shining their area, their cleaning order was like that; they start cleaning with horizontal areas, then go on with vertical areas and finally finishing it with shelf and cabinet interiors. In this way, the necessary unnecessary materials can be separated, the environment and work area will be neat and clean, there will be no materials, oil, water, dust, and tools around the working area that can cause accidents or unproductivity. Figure 2.8 represents before-and-after pictures of shine implementation.

Figure 2.8 Shine implementation

2.1.3.4 Standardization Implementation

The purpose of standardization is to set out the rules and conditions to keep the tidiness and cleaning done. To standardize, roles and responsibilities, they must be clearly and consistently applied [102]. This can be achieved by identification labels, visual controls, color-coding, and checklists. So, the used cleaning schedule of a team is shown in Table 2.2.

Table 2.2 Cleaning schedule

TEAM 1 CLEANING PLAN

MONTH:

								1. WEEK						2. WEEK						3. WEEK						4. WEEK						5. WEEK					
	CONTROL AREA	CLEANING STANDART	CLEANING & CONTROL METHOD	REQ. TOOL & MATERIAL	ABNORMAL ACTION	CONTROL FREQUENCY	RESPONSIBLE	MON	TUE	WED	THU	FRİ	SAT	MON	TUE	WED	THU	FRİ	SAT	MON	TUE	WED	THU	FRİ	SAT	MON	TUE	WED	THU	FRİ	SAT	MON	TUE	WED	THU	FRİ	SAT
DAILY CLEANING CONTROLS																																					
1	WELD GRINDING AREA	No undefined materail and slag	Visual Check	Sweeper, Shovel		16.40 17.00	Mr A																														
2	ASSEMBLY BENCH	No undefined materail, No stamped plates etc.	Visual Check	Sweeper, Shovel		16.40 17.00	Mr B																														
3	MACHINE TOOL	Put in order and wipe with swab	Visual Check	Swab		16.40 17.00	Mr C																														
4	PROJECT TABLE	Dust, spiral shavings to be cleaned	Visual Check	Sweeper, Shovel		16.40 17.00	Mr C																														
WEEKLY CLEANING CONTROLS																																					
5	INSIDE OF COLUMNS AND COLUMN SPACES	No undefined material, no dust	Visual Check	Sweeper, Shovel		SATURDAY 15.15 15.30	Mr B	1. WEEK						2. WEEK						3. WEEK						4. WEEK						5. WEEK					
6	WELDING MACHINE PARKING AREA	No undefined material, no dust	Visual Check	Sweeper, Shovel		SATURDAY 15.15 15.30	Mr C	1. WEEK						2. WEEK						3. WEEK						4. WEEK						5. WEEK					
6 MONTHS CLEANING CONTROL																																					
7	COLUMNS AND WALLS	Wipe off Colomns and walls	Visual Check	Swab, Pail		FIRST WEEKS OF JANUARY AND JULY	ALL TEAM MEMBERS	1.												2.																			

2.1.3.5 Implementation of Sustaining Step

Each team are inspected in weekly periods by the check list given in Table 2.3. If any team has more than 80 points through 8 weeks its inspection loop decrease to monthly periods. But if it takes below 80 points in any inspection, it turns to weekly period again and it go on like that. These weekly point of each team are averaged at the end of each month and they have 5S team points, these points are also evaluated 5S points of team members. Finally, corrective measures were implemented, consisting in tidying up, organizing, cleaning, normalizing and establishing control measures in workstations. Afterwards, the evaluation checklist was performed again and was set as a routine task to instil a continuous improvement environment and for ensuring the last 5S step: sustain.

Table 2.3 5S Evaluation check list

F-YST-003/02 (1)

5S INSPECTION FORM

Inspection Area	:	1. Step Points (max 10) :	10
Responsible/Team Leader	:	2. Step Points (max 40) :	40
Inspectors	:	3. Step Points (max 20) :	20
Inspection Date	:	4. Step Points (max 10) :	10
Previous Inspection Date	:	5. Step Points (max 20) :	20
		Total Points :	100
		Previous Inspection Points :	

	QUESTIONS	FINDINGS	NO of FINDINGS	POINT
1. STEP : SORTING				
1	Are unnecessary elements removed from the site? All elements in the field should be relevant to the work performed. It should be asked if the elements which do not have a place description are related to the work done (including drawer interior). It should be questioned whether the materials are more than the required quantity at the defined location (for example, if there are 3 instead of 1 water gauge).			10
2. STEP: ARRANGEMENT + DEFINITION				
2	Is everything on the site defined (including the locker interior)? The location of all necessary elements on the site should be defined. The equipment must be located with the loaction line and identifications must be done (label / template, etc.).			10
3	Are the location descriptions complied with? (including the locker interior) Line, label, quantity definitions must be obeyed. Elements above / outside the line; there should not be elements that are incompatible with the definition and quantity on the label, and elements shouldn't be mixed in boxes. All materials must be complete and on defined place.			10
4	Are shading made in the description of machine equipment and hand tools? The location of the equipment must be drawed as equipment's shape.			10
5	Is the arrangement in the field taking into account occupational safety / ergonomics? All necessary PPE must be defined, warning signs must be identified, Equipment arrangement should be made considering ergonomics. EX: Difficult to open and close drawer, no slippery floor warning, stacking of heavy materials at high height, no elements in the walkways / emergency exit doors, the material exceeding the tonnage capacity should not be on the stand, the stand tonnage capacities should be defined.			10
3. STEP: CLEANING + TIDYNESS				
6	Machinery, equipment, trolley, cabinets clean, painted, undamaged? Are the labels and signs clean? Are the waste disposed of in the right places? Broken glass, spilled paints, broken table, chair etc. should not be. Labels, tape and paints must be clean and free of wear. Papers in paper waste bin, plastics in plastic waste bin, etc. must have been thrown. Domestic waste should not be thrown into wire waste bins (due to fire risk). Spiral grindings should not be thrown into the trash / waste bin.			10
7	Is the work area clean and cleaning up? Have measures been taken for dirt sources? Are the necessary cleaning materials available? Is there a cleaning plan and is it up to date? Is cleaning of common areas defined? Rest area, work area floor, wall bottoms, cabinets, tool board, tool leader area, must be clean. The necessary cleaning materials should be available. Cleaning plan; cleaning standard, method, cleaning equipment, period, time, responsibilities should be indicative. Must be filled up to date. Responsibilities for cleaning should include the sharing of work, including common areas.			10
4. STEP: STANDARDIZATION				
8	Are there situations in the workspace that do not meet the defined standards? Are the tape, paint, label and signs used in the specifications in accordance with the standards? Do the documents in the work area comply with the standards? Identification methods that comply with standards should be used. There should be no definitions or regulations in the fields that do not comply with the standards. The site should not contain outdated, old documents that are not defined in accordance with our document system.			10
5. STEP: DISCIPLINE + IMPROVEMENT				
9	Does the team leader implement a defined audit system to maintain and improve the order of the workplace? Defined audits should be performed and the results should be exhibited on the team board. The published audit results should be shown on the team board, shared with the team members, and the task distribution planning required for the completion of the actions among the team members should be made.			10
10	Are detected actions related to nonconformities tracked by follow-up lists? Deficiencies in the field should be written in the action follow-up lists with the responsible and target dates. There should be no past actions. (There should be planned actions in the last 1 week - otherwise it should be zero) EX: In an April audit, actions planned for the last January should not be seen.			10
		Inspection Point:		100

Comments:

With this application, it is aimed to classify semi-finished products in operation, to determine, sort and clean of unnecessary materials, to determine stocking methods of intermediate stock areas, to determine the cleaning works to be done to minimize equipment failures, to adopt environmental cleaning for workers' motivation and to make them habits and methods have been established and the earnings of 5S to operation is explained. In this way, the provision of a disciplined 5S application is ensured.

2.2 KAIZEN Suggestions Application

Kaizen has continuity. Therefore, an employee must continuously take steps to improve. They should be able to offer suggestions and improvements over and over again for the solution of the problems. Instead of spending money on the solution, the idea must be spent. For this reason, the Kaizen suggestion system plays an important role in the substantial success of our 5S study. It is very important that employees generate ideas for their working methods in their area of expertise, present them in the form of suggestions, and archive them. At the firm we are practicing, tangible suggestions for the improvement that employees produce are recorded in Kaizen documents and these ideas are rewarded to the extent of the concrete improvements the owners have made (see Table-2.4). The number of suggestions per employee is statistically evaluated, the role of the suggestions of the employees in the general improvement of the company and the Kaizens they execute are followed.

Table 2.4 Classification and Reward System of Kaizen Suggestions

Baskets	**1st Basket**	**2nd Basket**
Suggestion Categories	Simplicity In Process Quality Autonomous Maintenance	Near Miss(KRK) 5S Ergonomi
Rewards	20 TL / Kaizen Quarter Gold Coin for Best Kaizen	5 TL / KRK Kaizen 10 TL / 5S & Ergonomi Kaizen Quarter Gold Coin for Best Kaizen

Suggestions are collected in 6 categories and they are voted by workers for best suggestion selection in two baskets. Suggestion categories in the first basket are; Simplicity, In-Process Quality and Autonomous Maintenance, the second basket

categories are; Near Miss (KRK), 5S and Ergonomy categories. Simplicity suggestions are classified as suggestions that simplify and accelerate existing works of workers. In-Process Quality suggestions are classified as suggestions that eliminate regular quality non-conformities which requires turn backs in the process and increases the cycle time. Autonomous Maintenance suggestions are classified as suggestions that prevent the machines' dirtiness, breakdowns, decrease maintenance durations and increase the abilities, productivity or utility of the machines. Near Miss (KRK) suggestions are classified as suggestions that prevent occupational accidents, waste times, waste movements, overconsumption of materials, etc.. 5S suggestions are classified as suggestions that prevent dirtiness of working area or maintain easy or good tidiness and cleanliness of working and stock areas. Ergonomy suggestions are classified as suggestions that maintain more ergonomic working conditions for workers.

The number of suggestions per employee is statistically evaluated, the role of the suggestions of the employees in the general improvement of the company and the Kaizens they execute are followed. Total money rewards to encourage workers are as in Table 2.5.

Table 2.5 Total wages of Kaizen suggestion rewards

Date	Sude Kaizen Wages (TL)	Çiltuğ Kaizen Wages (TL)
June-August 2015	1760	1490
Sept.-Nov. 2015	1345	1150
Dec.-Jan.-Feb.(2015-2016)	410	240
March 16	280	380
April 16	280	240
May-June 2016	160	360
Total	4235	3860
Average	222	203
Quarter Gold Coins	12 Quarter Gold Coins	12 Quarter Gold Coins

2.3 Work Analysis and Evaluation

A questionnaire is used, observation and interviewing work analysis techniques are also used simultaneously. In the questionnaire study, necessary parts are filled by analysts and information is gained from workers. After that, a feedback study is done by the top levels. Jobs are evaluated by using the point method by using Analytical

Hierarchy Process. Both results and conclusions are given in the project.

2.3.1 Preparing Work Analysis Form

The work analysis form includes four main parts :

1. Information about task
2. Necessary minimum attributes for work
3. Organizational relations
4. A necessary effort for the task

- Task information provides a brief explanation of the tasks. Descriptions should be composed of short and right sentences that include information about how the job is done.

- Necessary minimum attributes for work explain the minimum requirements of the job and it should be different from job descriptions. The job description is related to the job but specifications are related to the characteristics of the person who works in that area.

An example work analysis form is shown in Appendix 2.

2.3.2 Work Analysis

As Project Chief guided. Mechanic Workshop, Electrical Workshop, Chipping Production Workshops are visited. The survey study is applied and simultaneously information is gained by interviewing. Another method is called observation which is also applied too. All jobs and the number of people who work in the factory are given below in Table 2.6 All obtained job descriptions are shown in Appendix 3. For obtaining these job descriptions a work analysis form is used as an interface, which is filled during the interviews. A sample work analysis application form is shown in Appendix 4.

Table 2.6 Number of jobs and people that work analysis applied in the factory area

No	JOBS	Number of people
1	Factory Administrator	1
2	Project Chief	1
3	Production Chief	3
4	Inventory/Stock Chief	1
5	Quality Control Chief	1
6	Assist of Inventory/Stock Chief	2
7	Technical Drawer	1
8	Computer Operator	1
9	Mechanical Department Foreman	2
10	Mechanical Maintenance & Construction Chief	1
11	Electrical Maintenance & Construction Chief	1
12	Assembly Expert	1
13	Twisting Operator	2
14	Turning Operator	11
15	CNC Cutting Operator	2
16	Milling Worker	2
17	Sandblasting & Dyeing	2
18	Painter	1
19	Welder	25
20	Cleaner	2

2.3.3 Work Evaluation

2.3.3.1 Selection of Evaluation Technique

Work Analysis forms are observed for the evaluation part. The point method is used and points are given concerning comparison results. All jobs are evaluated. The main factors should include all factors that reflect all jobs. After making comparisons, the point table is prepared. Points are given over 1,000. All main and sub-factors are given below:

1. **Skill**

- Education, experience, private ability, communication, basic knowledge

2. **Responsibility**

- Human, documentation, machine

3. **Mental Effort**

- Coordination, attention, memory, observation

4. **Body Effort**

- Standing, moving, sedentary

5. **Environmental conditions**

- Working conditions, working risks.

2.3.3.2 AHP Calculations of Main and Sub Factors in Work Evaluation

What is AHP Method?

The Analytical Hierarchy Process (AHP), which was developed as a decision support tool in 1970, is used to investigate multi-criteria decision problems. AHP is an important tool because it uses both objective and subjective assessment criteria, ensures the consistency of the evaluation, and, in particular, a very important decision by which the decision-maker should be given priority among the alternatives that need to be assessed according to a large number of criteria [103, 104].

Where AHP is used?

• Business evaluation,

• Alternative selection,

• Profit/loss comparisons,

• Estimation of possible outputs,

• Checking changes in the decision-making system,

• The group facilitates decision making [103]

Why AHP is used?

• The performance evaluation study should have a multi-criteria structure,

• Lack of assessment and errors due to the inability of the traditional performance evaluation methods to assess the qualitative criteria objectively;

• Consistency of traditional performance evaluation methods, limited by practitioners' skills and knowledge,

• The majority of traditional performance evaluation methods are far from providing information to the manager at the end of the application [103, 104].

What are the advantages of AHP usage?

• The multi-criteria included in the work evaluation application can be analyzed analytically,

• It will be possible to carry out objective and subjective evaluation criteria together,

• The consistency of evaluations can be measured,

• The weighting of the factors and sub-factors that need to be evaluated according to a large number of criteria will be ensured [103].

By using the 1-9 AHP Scale, first of all, the scales of main factors (skill, responsibility, mental effort, body effort, environmental conditions) are calculated. Then this scale matrice is normalized.

After that same calculation is done to the sub-factors. By doing these calculations the percentages of all main and subfactors were obtained.

In the next step, main factors and their sub-factors, factor degrees (1 to 5) and percentages of all main and sub-factors are defined. As required in point method points of all factors and factor degree points are calculated according to the AHP method. In that method factor degrees are referred like these:

1: Perfect 2: Good 3: Medium

4: Weak 5: Bad

Table 2.7 Matrix of Factor Degrees

	Perfect	**Good**	**Medium**	**Weak**	**Bad**
Perfect	1.00	3.00	5.00	7.00	9.00
Good	0.33	1.00	3.00	5.00	7.00
Medium	0.20	0.33	1.00	3.00	5.00
Weak	0.14	0.20	0.33	1.00	3.00
Bad	0.11	0.14	0.20	0.33	1.00

Degree weight points are calculated by normalizing this matrice (Table 2.7). And calculated as ;

Perfect= 0.503 Good= 0.260 Medium= 0.134 Weak= 0.068 Bad= 0.035

$$Degree\ point = \frac{\text{Degree weight point} * \text{Point}}{\text{Largest Degree Point}} \quad (2.1)$$

Factor degree points are calculated by using Equation 2.1. An example is shown below with Equation 2.2.

$$\text{Educations'1st Degree Point} = \frac{0{,}035 * 249}{0{,}503} = 17 \quad (2.2)$$

All of these and consistency rate calculations are shown below with the following tables (See tables from Table 2.8 to Table 2.22):

Table 2.8 Matrix of Main factors

criteria	Skill	Mental Effort	Responsibiity	Body Effort	Environmental Conditions
Skill	1.000	3.000	5.000	7.000	9.000
Mental Effort	0.333	1.000	3.000	5.000	7.000
Responsibiity	0.200	0.333	1.000	3.000	5.000
Body Effort	0.142	0.200	0.333	1.000	3.000
Environmental Conditions	0.111	0.142	0.200	0.333	1.000
Column Sum	1.786	4.675	9.533	16.333	25.000

Table 2.9 Normalized matrix of main factors

Criteria	Skill	Mental Effort	Responsibiity	Body Effort	Environmental Conditions	row average
Skill	0.5598	0.6417	0.5245	0.4286	0.3600	0.50291
Mental Effort	0.1866	0.2139	0.3147	0.3061	0.2800	0.26026
Responsibiity	0.1120	0.0712	0.1049	0.1837	0.2000	0.13435
Body Effort	0.0795	0.0428	0.0349	0.0612	0.1200	0.06769
Environmental Conditions	0.0622	0.0304	0.0210	0.0204	0.0400	0.03479

Table 2.10 Matrix of sub-factor skill

criteria	Education	Experience	Private Ability	Communication	Basic Knowledge
Education	1.000	3.000	4.000	5.000	9.000
Experience	0.333	1.000	1.000	3.000	5.000
Private Ability	0.250	1.000	1.000	3.000	5.000
Communication	0.200	0.333	0.330	1.000	3.000
Basic Knowledge	0.111	0.200	0.200	0.333	1.000
Column Sum	1.894	5.533	6.530	12.333	23.000

Table 2.11 Normalized matrix of sub-factor skill

criteria	Education	Experience	Private Ability	Communication	Basic Knowledge	row average
Education	0.5279	0.5422	0.6126	0.4054	0.3913	0.49587
Experience	0.1760	0.1807	0.1531	0.2432	0.2174	0.19409
Private Ability	0.1320	0.1807	0.1531	0.2432	0.2174	0.18530
Communication	0.1056	0.0602	0.0505	0.0811	0.1304	0.08557
Basic Knowledge	0.0586	0.0361	0.0306	0.0270	0.0435	0.03917

Table 2.12 Matrix of sub-factor responsibility

criteria	Tool&Machine	Human	Documentation
Tool&Machine	1.000	3.000	5.000
Human	0.333	1.000	3.000
Documentation	0.200	0.333	1.000
Column Sum	1.533	4.333	9.000

Table 2.13 Normalized matrix of sub-factor responsibility

criteria	Human	Machine	Documentation	row average
Human	0.6523	0.6924	0.5556	0.63341
Documentation	0.2172	0.2308	0.3333	0.26045
Machine	0.1305	0.0769	0.1111	0.10614

Table 2.14 Matrix of sub-factor body effort

criteria	Standing	Moving	Sedentary
Standing	1.000	3.000	5.000
Moving	0.333	1.000	3.000
Sedentary	0.200	0.333	1.000
Column Sum	1.533	4.333	9.000

Table 2.15 Normalized matrix of sub-factor body effort

criteria	Standing	Moving	Sedentary	row average
Standing	0.6523	0.6924	0.5556	0.63341
Moving	0.2172	0.2308	0.3333	0.26045
Sedentary	0.1305	0.0769	0.1111	0.10614

Table 2.16 Matrix of sub-factor mental effort

criteria	Coordination	Attention	Memory	Observation	Control
Coordination	1.000	3.000	5.000	7.000	9.000
Attention	0.333	1.000	3.000	5.000	7.000
Memory	0.200	0.333	1.000	3.000	5.000
Observation	0.142	0.200	0.333	1.000	3.000
Control	0.111	0.142	0.200	0.333	1.000
Column Sum	1.786	4.675	9.533	16.333	25.000

Table 2.17 Normalized matrix of sub-factor mental effort

criteria	Coordination	Attention	Memory	Observation	Control	row average
Coordination	0.560	0.642	0.524	0.429	0.360	0.503
Attention	0.186	0.214	0.315	0.306	0.280	0.260
Memory	0.112	0.071	0.105	0.184	0.200	0.134
Observation	0.080	0.043	0.035	0.061	0.120	0.068
Control	0.062	0.030	0.021	0.020	0.040	0.035

Table 2.18 Matrix of sub-factor environmental conditions

criteria	Working conditions	Working risks
Working conditions	1.000	3.000
Working risks	0.333	1.000
Column Sum	1.333	4.000

Table 2.19 Normalized matrix of sub-factor environmental conditions

criteria	Working conditions	Working risks	Row Average
Working conditions	0.750	0.750	0.750
Working risks	0.250	0.250	0.250

Table 2.20 Calculation Tables of Consistency Rates - 1/3

FACTOR DEGREES	A						w	A*w	(A*w)/w			(λ-n)/(n-1)		CI/RCI	
		Perfect	Good	Medium	Weak	Bad	Weights			λ	n	Consistency Index (CI)	Random Consistency Index (RCI)	Consistency Rate	Result
	Perfect	1	3	5	7	9	0,503	2,744	5,455						
	Good	0,33	1	3	5	7	0,26	1,413	5,435						
	Medium	0,2	0,33	1	3	5	0,134	0,699	5,219	5,226	5	0,057	1,12	0,0505	Consistent
	Weak	0,14	0,2	0,33	1	3	0,068	0,340	4,995						
	Bad	0,11	0,14	0,2	0,33	1	0,035	0,176	5,028						

MAIN FACTORS	A						w	A*w	(A*w)/w			(λ-n)/(n-1)		CI/RCI	
	criteria	Skill	Mental Effor	Responsibiity	Body Effort	Environmental Conditions	Weights			λ	n	Consistency Index (CI)	Random Consistency Index (RCI)	Consistency Rate	Result
	Skill	1	3	5	7	9	0,503	2,744	5,455						
	Mental Effort	0,33	1	3	5	7	0,26	1,413	5,435						
	Responsibiity	0,2	0,33	1	3	5	0,134	0,699	5,219	5,226	5	0,057	1,12	0,0505	Consistent
	Body Effort	0,14	0,2	0,33	1	3	0,068	0,340	4,995						
	Environmental Conditions	0,11	0,14	0,2	0,33	1	0,035	0,176	5,028						

SKILL	A						w	A*w	(A*w)/w			(λ-n)/(n-1)		CI/RCI	
	criteria	Education	Experience	Private Ability	Communication	Basic Knowledge	Weights			λ	n	Consistency Index (CI)	Random Consistency Index (RCI)	Consistency Rate	Result
	Education	1	3	4	5	9	0,469	2,569	5,473						
	Experience	0,33	1	3	5	7	0,274	1,492	5,444						
	Private Ability	0,25	0,33	1	3	5	0,146	0,757	5,186	5,251	5	0,063	1,12	0,0561	Consistent
	Communication	0,2	0,2	0,33	1	3	0,075	0,378	5,015						
	Basic Knowledge	0,11	0,14	0,2	0,33	1	0,035	0,181	5,140						

Table 2.21 Calculation Tables of Consistency Rates - 2/3

RESPONSIBILITY	A			w	A*w	(A*w)/w			(λ-n)/(n-1)		CI/RCI	
criteria	**Tool& Machine**	**Human**	**Documentation**	**Weights**			**λ**	**n**	**Consistency Index (CI)**	**Random Consistency Index (RCI)**	**Consistency Rate**	**Result**
Tool&Machine	1	3	5	0,63341	1,945	3,071						
Human	0,33	1	3	0,26045	0,790	3,033	3,039	3	0,019	0,58	0,0334	Consistent
Documentation	0,2	0,33	1	0,10614	0,320	3,011						

BODY EFFORT	A			w	A*w	(A*w)/w			(λ-n)/(n-1)		CI/RCI	
criteria	**Standing**	**Moving**	**Sedentary**	**Weights**			**λ**	**n**	**Consistency Index (CI)**	**Random Consistency Index (RCI)**	**Consistency Rate**	**Result**
Standing	1	3	5	0,63341	1,923	3,036						
Moving	0,33	1	3	0,26045	0,776	2,981	3,039	3	0,020	0,58	0,0339	Consistent
Sedentary	0,2	0,33	1	0,101614	0,315	3,101						

MENTAL EFFORT	A					w	A*w	(A*w)/w			(λ-n)/(n-1)		CI/RCI	
criteria	**Coordination**	**Attention**	**Memory**	**Observation**	**Control**	**Weights**			**λ**	**n**	**Consistency Index (CI)**	**Random Consistency Index (RCI)**	**Consistency Rate**	**Result**
Coordination	1	3	5	7	9	0,503	2,744	5,455						
Attention	0,33	1	3	5	7	0,26	1,415	5,441						
Memory	0,20	0,3333333	1	3	5	0,134	0,700	5,226	5,243	5	0,061	1,12	0,0543	Consistent
Observation	0,14	0,2	0,333333333	1	3	0,068	0,342	5,022						
Control	0,11	0,1428571	0,2	0,333333333	1	0,035	0,177	5,071						

Table 2.22 Calculation Tables of Consistency Rates - 3/3

ENVIRONMENTAL CONDITIONS	A			w	A*w	(A*w)/w			(λ-n)/(n-1)		CI/RCI	
	criteria	Working conditions	Working risks	Weights			λ	n	Consistency Index (CI)	Random Consistency Index (RCI)	Consistency Rate	Result
	Working conditions	1	3	0,49587	1,078	2,174	2,013	2	0,013	0	-	-
	Working risks	0,333	1	0,19409	0,359	1,851						

Random Consistency Index											
	n	1	2	3	4	5	6	7	8	9	10
	RG	0	0	0,58	0,9	1,12	1,24	1,32	1,41	1,45	1,49

2.3.3.3 Points of Factors & Factor Degree Points

In this step, according to job descriptions that are defined before, the points of subfactors of each job are given as in Table 2.20 and then each point of the job is calculated based on Table 2.20. After that these points are summed and total points of jobs are obtained as in Table 2.21, point calculation tables of jobs can be seen in Appendix 5.

Table 2.23 Points of factor and sub-factor degrees

FACTORS	PERCENT	POINT	FACTOR DEGREE POINTS				
			1	2	3	4	5
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Conrol	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Table 2.24 Calculated Points of jobs

	Point	Name of Job
1	648	Factory Administrator
2	638	Production Chief
3	549	Project Chief
4	504	Mechanical Department Foreman
5	487	Quality Control Chief
6	335	Technical Drawer
7	325	Inventory/Stock Chief
8	323	Welder
9	318	Computer Operator
10	284	Twisting Operator
11	277	Assist of Inventory Stock
12	270	Electrical Maint.&Construction C.
13	250	Assembly Expert
14	246	Mechanical Maintanence&Const.C
15	245	Milling Operator
16	239	CNC Cutting Operator
17	238	Turning Operator
18	203	Sandblasting & Dyeing
19	197	Painter
20	154	Cleaner

2.4 Salary System According to Point Method Results

It is possible to establish the relation between wage and work value more healthily and more easily because the score of the work in terms of the points, in other words, the values are determined in the point method. At the end of this established relation, a mathematical result will be seen as a linear or curved line. The least-squares

method, which is a mathematical method, can be used to establish this relationship. By applying the method, the root wage curve of the foundation is determined.

In the coordinate system (x, y) used when the wage line or curve is drawn, the value is indicated as the work point on the x-axis and the work wage (hourly, daily, monthly) is shown on the y-axis.

Using the point method, the wage of jobs is defined through the following phases.

2.4.1 Drawing the wage line or curve of organization

The Least Squares method is used for drawing the wage line or wage curve of the organization.

a. For linear wage model Equation 2.3 and Equation 2.4 are used for finding linear wage equations:

$$\sum y = a.N + b.\sum x \tag{2.3}$$

$$\sum xy = a.\sum x + b.\sum x^2 \tag{2.4}$$

Where x scores, y prices, and N are the number of jobs available. The formula that can be obtained as a result of calculations is shown in Equation 2.5:

$$y = a + bx \tag{2.5}$$

b. For parabolic wage model Equation 2.6 and Equation 2.7 are used for finding curved wage equations:

$$\sum 1/y = a.N + b.\sum x \tag{2.6}$$

$$\sum x / y = a.\sum x + b.\sum x^2 \tag{2.7}$$

Where x scores, y prices, and N are the number of jobs available. The formula that can be obtained as a result of calculations is shown in Equation 2.8:

$$y = 1 / (a + bx) \tag{2.8}$$

We used the parabolic wage model in this study. Here, as the score increases, it is seen that the coefficient b must be negative for the increase in the wage. With the help of this equation, wages can be calculated as in Table 2.22. The wages given in Table 2.22 are the result of the work evaluation done in the business and the products falling in the range of the points are multiplied by the monthly working hours. When

these wages are calculated, the actual data of the operator and the trade unions are taken into account. From here to pass base wages a wage parabola should be drawn. Wage curves are often used because no linear wage curve is found in business environments. Wage curves are graphical tools that show the wage movement of jobs at a certain point interval. The wage parabola is plotted with the help of Equation 8 to obtain base values for the wages.

Calculation of "r" Value in Table-2.21 for White Collar Workers:

Factory management decided maximum and minimum wage values as 15.000 TL and 2.400 TL respectively. And there are 7 jobs under white-collar job classification. So r-value of a geometric sequence is calculated as below in Equation 2.9:

$$r = \sqrt[n-1]{\frac{a_n}{a_1}} = \sqrt[7-1]{\frac{15,000}{2,400}} = 1,357208808 \quad (2.9)$$

Calculation of "r" Value in Table-2.21 for Blue Collar Workers:

Factory management decided maximum and minimum wage values as 3.195 TL and 1.270 TL respectively. And there are 13 jobs under blue-collar job classification. So r-value of a geometric sequence is calculated as below in Equation 2.10:

$$r = \sqrt[n-1]{\frac{a_n}{a_1}} = \sqrt[13-1]{\frac{3,195}{1,270}} = 1,079913396 \quad (2.10)$$

Table 2.25. Calculation of wages according to points.

Personnel Categories	No	Name of Job	Point (X)	Proposed Wage by Geo. Seq. (r=1,3572) (Y)	X^2	XY	1/Y	X/Y
WHITE COLLAR	*1*	Factory Administrator	648	15.000	419.904	9.720.000	0,0000667	0,0432
	2	Production Chief	638	11.052	407.044	7.051.236	0,0000905	0,0577266
	3	Project Chief	549	8.143	301.401	4.470.646	0,0001228	0,0674178
	4	Quality Control Chief	487	6.000	237.169	2.922.000	0,0001667	0,0811667
	5	Technical Drawer	335	4.421	111.890	1.478.770	0,0002262	0,0756644
	6	Inventory/Stock Chief	325	3.257	105.625	1.058.623	0,000307	0,0997759
	7	Computer Operator	318	2.400	101.124	763.200	0,0004167	0,1325
		∑	**3.300**	**50.273**	**1.684.157**	**27.464.475**	**0,001396**	**0,557451**
	No	**Name of Job**	**Point (X)**	**Proposed Wage by Geo. Seq. (r=1,0799) (Y)**	**X^2**	**XY**	**1/Y**	**X/Y**
BLUE COLLAR	*1*	Mechanical Department Foreman	504	3.195	254.016	1.610.280	0,000313	0,1577465
	2	Welder	323	2.959	104.329	580.108	0,0005568	0,1798441
	3	Twisting Operator	284	2.740	80.656	582.200	0,0004878	0,1385366
	4	Assist of Inventory Stock	277	2.537	76.729	472.285	0,0005865	0,1624633
	5	Elect. Maint.&Construction C.	270	2.349	72.900	560.250	0,0004819	0,1301205
	6	Assembly Expert	250	2.175	62.500	470.000	0,0005319	0,1329787
	7	Mech. Maint.&Construction C.	246	2.014	60.516	461.250	0,0005333	0,1312
	8	Milling Operator	245	1.865	60.025	437.080	0,0005605	0,1373318
	9	CNC Cutting Operator	239	1.727	57.121	382.400	0,000625	0,149375
	10	Turning Operator	238	1.599	56.644	361.284	0,0006588	0,1567852
	11	Sandblasting & Dyeing	203	1.481	41.209	293.335	0,000692	0,1404844
	12	Painter	197	1.371	38.809	284.665	0,000692	0,1363322
	13	Cleaner	154	1.270	23.716	197.582	0,0007794	0,1200312
		∑	**3.430**	**27.284**	**989.170**	**6.692.719**	**0,007499**	**1,87323**
		Total of Blue and White Collars	**6.730**	**77.557**	**2.673.327**	**34.157.194**	**0,008896**	**2,430681**

2.4.1.1 Wage Curve Equation for White Collar Personnels:

$$\sum 1/y = a.N + b.\sum x \quad (2.6) \qquad 0{,}001396 = 7a + 3.300\ b \quad (2.11)$$

$$\sum x/y = a.\sum x + b.\sum x^2 \quad (2.7) \qquad 0{,}557451 = 3.300\ a + 1.684.157\ b \quad (2.12)$$

The required value is put in Equations 2.6 and 2.7, so Equations 2.11 and 2.12 are obtained and solved. Thus, we found that the value a= 5,68 x 10^{-4}, and value b= -7,83 x 10^{-7}. Then we put these values in Equation 2.8, then the wage curve becomes as in Figure 2.9. And the equation of this curve shown in Equation 2.13.

$$y = [\ 1\ /\ (\ 5{,}68.10^{-4} - 7{,}83.10^{-7}\ .x\ )\ ] \qquad (2.13)$$

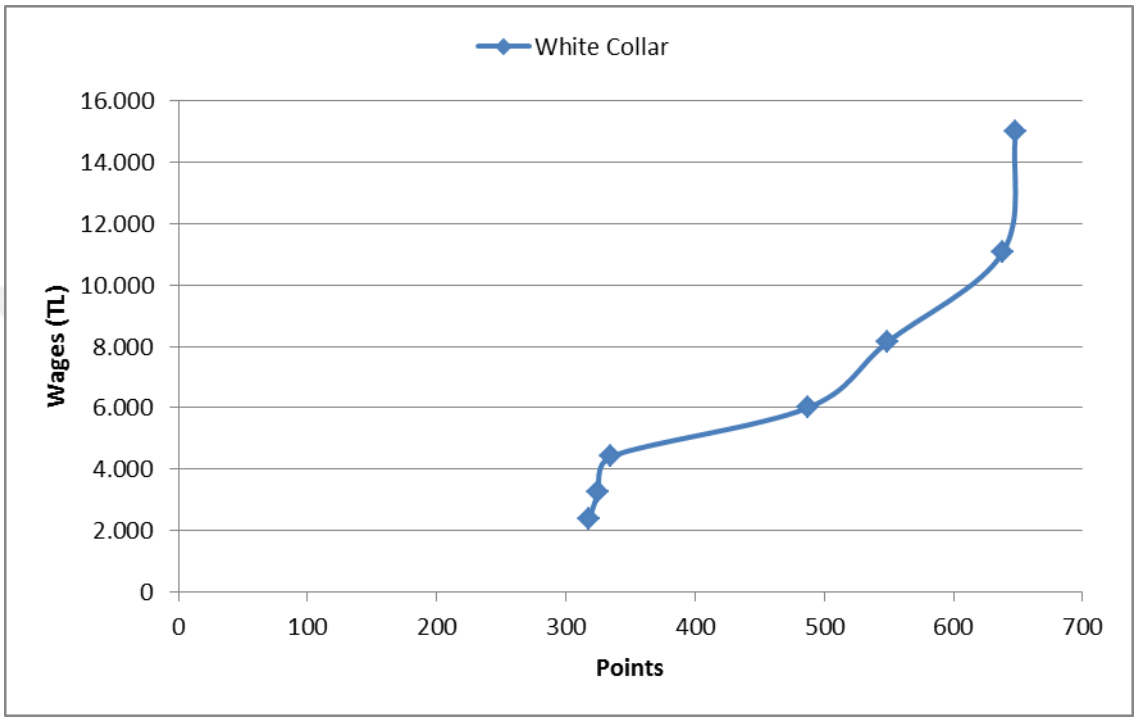

Figure 2.9 – White collar personnel wage curve

2.4.1.2 Wage Curve Equation for Blue Collar Personnels:

$$\sum 1/y = a.N + b.\sum x \qquad (2.6)$$

$$\sum x\ /\ y = a.\sum x + b.\sum x^2 \qquad (2.7)$$

$$0{,}007499 = 13a + 3.430\ b \qquad (2.14)$$

$$1{,}873230 = 3.430\ a + 989.170\ b \qquad (2.15)$$

The required value are put in the Equations 2.6 and 2.7, so Equations 2.14 and 2.15 are obtained and solved. Thus, we found that the value a= 9,07 x 10^{-4}, and the value b= -1,25 x 10^{-6}. Then we put these values in the Equation 2.8, then wage curve becomes as in Figure 2.10. And equation of this curve shown in Equation 2.16.

$$y = [\ 1\ /\ (\ 9{,}07.10^{-4} - 1{,}25.10^{-6}\ .x\ )\ ] \qquad (2.16)$$

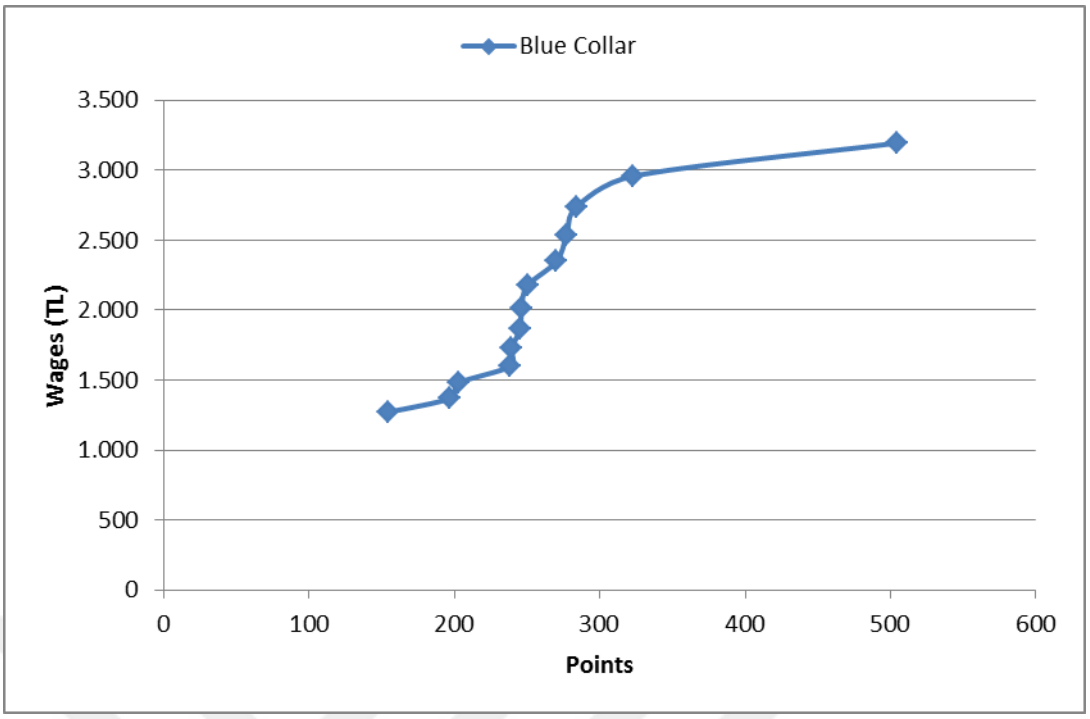

Figure 2.10 Blue collar personnel wage curve

2.5 Wage Increment According to Lean Management 5S Team Point

This method allows for wage increases according to team success on the application of the 5S tool of lean management. In the major area of the business, the wage increase is adopted according to 5S success and 5S evaluation forms are applied to realize this (5S teams are shown in Appendix-6). At the end of the evaluations made within a certain time, the basic principles governing the relation between the wage of the worker and the success of the team to which he/she belongs have been determined. This determination is calculated as the average 5S evaluation points in every 6 month periods for each team. The additional earnings that are used in the base of the average 5S evaluation point are summarized in Table 2.23. Additional earning ratios are defined with factory management that includes a board of members. Accordingly, these wage increments are added to workers' base wages as additional earning per month, without charge during the period of he/she works. If the worker was not affiliated with any 5S team or the 5S performance score of his/her team falls below 71, or if he/she is assigned to another position, that additional earning wasn't paid. This application wasn’t accepted as a condition of the employment contract and approved by the employees.

Table 2.26. Additional performance ratios based on team 5S scores

5S Point Range	Additional Earning (%)
0-70	0%
71-79	3%
80-89	5%
90-95	7%
96-100	10%

2.6 Sample Application for White Collar Workers

In this part, the work point and wage calculation of production chief is calculated for better demonstration. This demonstration will be explained step by step.

Step-1

The work analysis form is applied to the production chief's works. And according to this analysis, the job description of the production chief is defined as below.

Job Title: Production Chief

Summary:

Under general supervision, plans organize and coordinates the assigned projects. Prepares bills of materials, preparing technical drawings and controlling them. Also technical consulting, project planning, on-site coordination, contractor oversight.

Duties and Responsibilities:

1. Prepares bill specifications obtain material lists, and develops project plans and estimates.
2. Directs and oversees projects, coordinating with and serving as between departments and contractors, to ensure that deadlines are met and that projects comply with specifications, policies, regulations, and codes.
3. Inspects, approves, and accepts completed projects.

4. Orders equipment and services as appropriate.
5. Conducts presentations on project issues for management.
6. Collects and analyzes data; prepares scheduled and special reports; maintains program/project records and statistical information.

Minimum Job Requirements:

Bachelor's degree (university graduation degree) with 6 years of experience directly related to the duties and responsibilities specified.

Knowledge, Skills, And Abilities Required:

- Analytical approach.
- The ability to work with a team.
- Ability to analyze and develop appropriate systems and/or services solutions.
- Strong interpersonal and communication skills and the ability to work effectively with a wide range of constituencies in a diverse community.
- Knowledge and understanding of advanced systems, equipment, and services.
- Ability to gather and analyze data and generate reports.
- Knowledge of current technological developments/trends in the area of expertise.
- Knowledge of analysis techniques.
- Ability to communicate effectively, both orally and in writing.
- Knowledge of principles, procedures, regulations, and standards.
- Ability to develop and deliver presentations.
- Ability to develop project projections.

Working Conditions And Physical Effort:

- Work is normally performed in a typical interior/office work environment.
- No or very limited physical effort required in office work but so much in the work environment.

No or very limited exposure to physical risk in the office environment but so many risks about falling, crashing, cutting, electrical shock and temporary disorders in the body.

Step-2

In this step work point components are defined according to the job description as shown in Figure 2.11. So, the sum of these point components, which are yellow-colored in Figure 2.11, gives us the total work point of production chief. Thus, work point of production chief is

249+25+23+43+10+85+4+7+131+17+4+9+9+3+5+2+7+5=**638**.

Production Chief FACTORS	PERCENT	POINT	FACTOR DEGREE POINTS				
			1	2	3	4	5
1- SKILL	0.503	503					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	134					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	260					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Control	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	68					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	35					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Figure 2.11 Production Chief Work Point Assignment Table.

Step-3

Then in Step-3 sorting of jobs are done according to work points then wage value is calculated according to the geometric sequence. Sorting of white-collar jobs is shown in Figure 2.12.

Personnel Categories	No	Name of Job	Point (X)
WHITE COLLAR	1	Factory Administrator	648
	2	Production Chief	638
	3	Project Chief	549
	4	Quality Control Chief	487
	5	Technical Drawer	335
	6	Inventory/Stock Chief	325
	7	Computer Operator	318
		∑	**3.300**

Figure 2.12 White collar work point ranking table.

According to this ranking table with the predefined r value 1,3572 (See Equation 2.9), the wage of production chief is calculated with Equation 2.17 according to the geometric sequence.

$$a_n = a_1 * r^{(n-1)} \quad (2.17)$$

$$a_6 = a_1 * r^{(5)}$$

$$a_6 = 2.400 * 1{,}3572^{(5)}$$

$$a_6 = 11.052 \text{ TL}$$

There are no 5S teams or applications done for white-collar workers. So there aren't any 5S increment is applied for white-collar workers.

2.7 Sample Application for Blue Collar Workers

In this part, the work point and wage calculation of welder are calculated for better demonstration. This demonstration will be also explained step by step.

Step-1

The work analysis form is applied to welder's works. And according to this analysis, the job description of the welder is defined as below.

Job Title: WELDER

Summary:

Designs fabricate, joins and repair equipment, fixtures, and structures by using various welding techniques.

Duties and Responsibilities:

This is a journey-level job classification and is first in a series of two classifications. It is distinguished from the Welder, Lead classification which is comprised of certified welders with a broader base of welding experts who are proficient in the design, fabrication, joining and/or repair of space-age metals, scientific and research components. Welders are called upon to lift and carry heavy objects and work under conditions of restricted movement, a dirty environment, air contamination, intense noise, and hazardous materials.

- Designs fabricate, joins and/or repairs equipment, fixtures and various types of metal objects and structures using oxygen-acetylene, electric arc, MIG and TIG welding techniques.

- Operates drill presses, power saws, grinders, metal lathes and a variety of welding equipment and hand tools.

- Analyzes plans, drawings, work samples, specifications and work orders to determine work requirements and sequence of welding assignments.

- Estimates material and labor.

- Recommends supplies and materials to be ordered.

- May operate various snow removal equipment.

Minimum Job Requirements:

- Six years of welding experience; OR,

- Completion of an accredited four-year welder's training program; OR,

- Completion of an accredited two-year welder's training program AND two years of welding experience; OR,

- Any equivalent combination of experience, training and/or education approved by Human Resources.

- Possession of a current Arizona Type D driver's license upon employment.

Knowledge, Skills, And Abilities Required:

- Knowledge of applicable codes.

- Knowledge of welding techniques (oxygen-acetylene, electric arc, and TIG), tools and equipment.

- Skill in the design, fabrication, joining and repair of a variety of metal objects, equipment, fixtures, and structures. Ability to effectively communicate.

Step-2

In this step work point components are defined according to the job description as shown in Figure 2.13. So, the sum of this point components, which are yellow-colored in Figure 2.13, gives us the total work point of production chief. Thus, work point of production chief is

31+50+23+11+20+6+9+14+16+35+9+2+9+43+9+1+26+9=**323**.

Welder			FACTOR DEGREE POINTS				
FACTORS	PERCENT	POINT	1	2	3	4	5
1- SKILL	0.503	503					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	134					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	260					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Conrol	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	68					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	35					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Figure 2.13 Welder Work Point Assignment Table.

Step-3

Then in Step-3 sorting of jobs are done according to work points then wage value is calculated according to the geometric sequence. Sorting of blue-collar jobs is shown in Figure 2.14.

	No	Name of Job	Point (X)
BLUE COLLAR	1	Mechanical Department Foreman	504
	2	Welder	323
	3	Twisting Operator	284
	4	Assist of Inventory Stock	277
	5	Elect. Maint.&Construction C.	270
	6	Assembly Expert	250
	7	Mech. Maint.&Construction C.	246
	8	Milling Operator	245
	9	CNC Cutting Operator	239
	10	Turning Operator	238
	11	Sandblasting & Dyeing	203
	12	Painter	197
	13	Cleaner	154
		∑	**3.430**

Figure 2.14 Blue Collar Work Point Ranking Table.

According to this ranking table with the predefined r value 1,0799 (See Equation 2.10), the wage of production chief is calculated with Equation 2.17 according to the geometric sequence.

$$a_n = a_1 * r^{(n-1)} \quad (2.17)$$

$$a_{12} = a_1 * r^{(11)}$$

$$a_{12} = 1.270 * 1{,}3572^{(11)}$$

$$a_{12} = 2.959 \text{ TL}$$

Step-4

In this step, a welder should be reviewed for using his 5S team point. So we reviewed welder "İsmail ÜZEN" in this step. İsmail Üzen was in the team of Hasan Pektaş in October 2017, which is employed in Factory-1 (All list can be seen in Appendix-6). The performance of his teams through 6 months is shown in Figure 2.15 (All list can be seen in Table 3.3).

Worker	Name and Surname	May	June	July	August	September	October	6 Months Average
60	İSMAİL ÜZEN	69	76	87	90	86	87	83

Figure 2.15 5S team points of sample welder through 6months.

As shown in Figure 2.12, 6 months average 5S team point of İsmail Üzen is 83. So according to Table 2.23, this point comes into the range of 80-89. Consequently, his 5S wage increment becomes 5%. Finally, his final wage calculated as below:

2.959 TL * (1+0,05) = 3.107 TL.

2.8 Introduction of Çiltuğ

2.8.1 Company History and Information

Çiltuğ Heat Industry and Trade Inc. with its headquarters located in Gaziantep was founded and initiated its operations in Gaziantep province in year 1971 to respond to country-wide requirements and particularly requirements from east and southeast regions of our country and Turkey's neighboring countries in the Middle East and other third world countries regarding industrial installation, machinery, equipment and equipage and supply requirements regarding construction, infrastructure works and installation works.

Çiltuğ Heat Industry and trade Inc. as of its present state produces mechanical permanent equipment for dams, steel structure constructions and pressure vessels (steam boilers, LPG tanks, vertical/horizontal steel storage tanks, etc.) on a facility of a total of 17.000 m^2 area with 7.000 m^2 close and 10.000 m^2 open area in the Başpınar 1st Organized Industrial Zone in Gaziantep.

Çiltuğ's establishment with initiated its operations in Gaziantep on May 15th, 1971 as an unlimited company became an incorporation in 1976. Çiltuğ's establishment completed distribution and modernization stages by the year 1977 and started to develop as a group of companies as of the year 1980.

In Çiltuğ's production plant located in the Gaziantep 1st Organized Industrial Zone in the southeastern region of Anatolia in Turkey, production and installations are performed by its experienced technical personnel by international quality and standards since 15.07.2012, under the ISO 9001 Quality Management System. As of

01.03.2012, necessary work has also been initiated to bring in its establishment the ISO 14001 and OHSAS 18001 Management Systems and its establishment are entitled to receive these documents as of 07.12.2012.

Furthermore, Çiltuğ is employing 'Level-II' certified engineers under EN 473 and SNT-TC-1A Standard and tested welders under EN 287 standard from establishments accredited by international institutions regarding NDT tests. In addition to this, Çiltuğ is also getting part-time support from an Environmental Engineer and a full-time OHS Expert to ensure work safety and to reduce its operations' impact on the environment.

In its plant where it can produce 2.500 tons per year; it employs Senior Mechanical Engineer, Welding Engineer, Mechanical Engineer, Technical Trainer, Machine Technician and Technical Draftsman in the design artworks, project, planning, production, quality control, proposal, and contract units. On the other hand, about 250 experienced qualified personnel is employed for installation, welding, and site works.

Its heavy equipment factory located in Gaziantep 1st Organized Industrial Zone with 7.000 m^2 of close and 10.000 m^2 of open area is built at a distance of 220 km from İskenderun Port through TEM highway and 280 km from Mersin Port through TEM highway.

Nevertheless, in its new production plant built in the same zone with a 20.000 m^2 open area and a 5.000 m^2 close area, it has completed its technological and modern machinery, equipment infrastructure adequate for the production of wind tower segments of 31 meters, 70 tones.

CHAPTER 3

FINDINGS AND RESULTS

In this part of the study, findings and results are given in accordance with method application flow which is shown in Figure 2.1. All applied method results are listed or shown. For better understanding, an example application can be seen in part 2.6. There are earnings in three parts. These are the earnings of 5S applications, Kaizen applications, job analysis and evaluation applications and wage increment applications are shown. All of them gave solutions to chronic problems of the firm, where workers were slowing or stopping works because of wage increment dissatisfactions in additionally to unhealthy, dirty and untidy work environment and low occupational safety preventions.

3.1 Obtained Gains and Results of 5S Application

Although benefits of this methodology are not easily measurable [105], the following advantages were identified: less risk of work accidents, better working conditions, employees more engaged and with an overall better working attitude, organized workstations, optimized storage space, less movements from employees, reduction of unproductive times. Some improvement examples are shown between Figure 3.1 and Figure 3.6.

BEFORE	AFTER
Because of the irregular material placement before lean manufacturing, the view angle area of the manager looking at the window was restricted, occupied the area, causing irregularity and image pollution.	Along with the 5S application, in front of the window was opened, and a follow-up panel was put and the surrounding area was arranged.
	

Figure 3.1 Before and after photos-1

BEFORE	AFTER
The irregular use of scrap materials and area, bad cleaning of spot welds caused this business to lose productivity, time and labor, in addition to increasing occupational risks.	We have tried to remove this irregularity with our studies.
	

Figure 3.2 Before and after photos-2

BEFORE	AFTER
Wastes in the working environment poses a threat to the health of working staff.	Efforts have been made to create healthy conditions by cleaning up the resulting wastes.
	

Figure 3.3 Before and after photos-3

BEFORE	AFTER
The area at the end of the 3rd production hole before 5S application was busy with the scrapping of the area, causing irregularity and image pollution.	As a result of the studies done, field determination was made and scrap coins were started to be used for more smooth gathering of the scrap with the suggestions given.
	

Figure 3.4 Before and after photos-4

BEFORE	AFTER
Before 5S applications, waste parts and materials were puting under the work benchs.	As a result of our studies, the bottom of the work benchs have been cleaned and the throwing of waste or material has been prevented.
	

Figure 3.5 Before and after photos-5

BEFORE	AFTER
The disorder in the work space was like in the photo before 5S application.	With the works carried out within the scope of 5S mehodology, it was possible to determine the different areas for each material and to send unnecessary materials to the waste. Thus, the work space expanded and the safety of the personnel ensured.
	

Figure 3.6 Before and after photos-6

Furthermore, current state of workstations was found extremely helpful in identifying problems and potentiate further improvements in the manufacturing line, being considered invaluable upon the application of VSM, which ensured.

The target of workers for given KRK suggestion was 0.4 times of number of team member and for executed KRK suggestion was 0.3 times of team member per month. 1 year performance of teams is as shown in Figure 3.7.

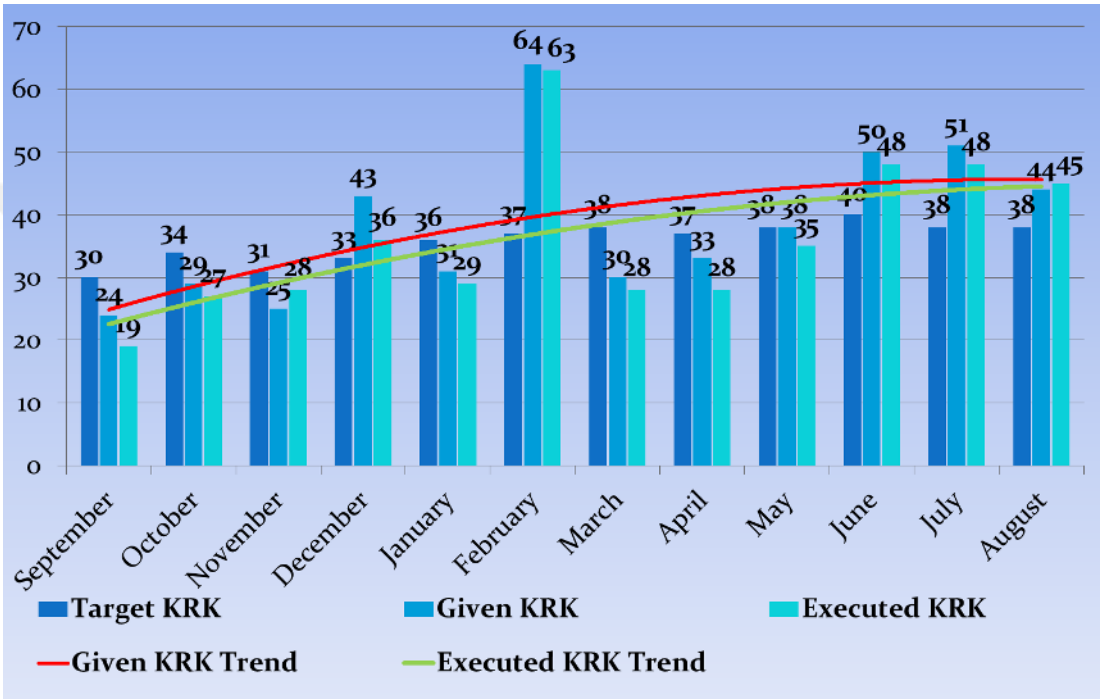

Figure 3.7 KRK distribution and Trend Graph.

The target of workers for given other Kaizen suggestions was 1 times of number of team member and for other executed Kaizen suggestions was 0.5 times of team member per month. 1 year performance of field 1 and 2 teams are as shown in Figure 3.8 and 3.9 respectively.

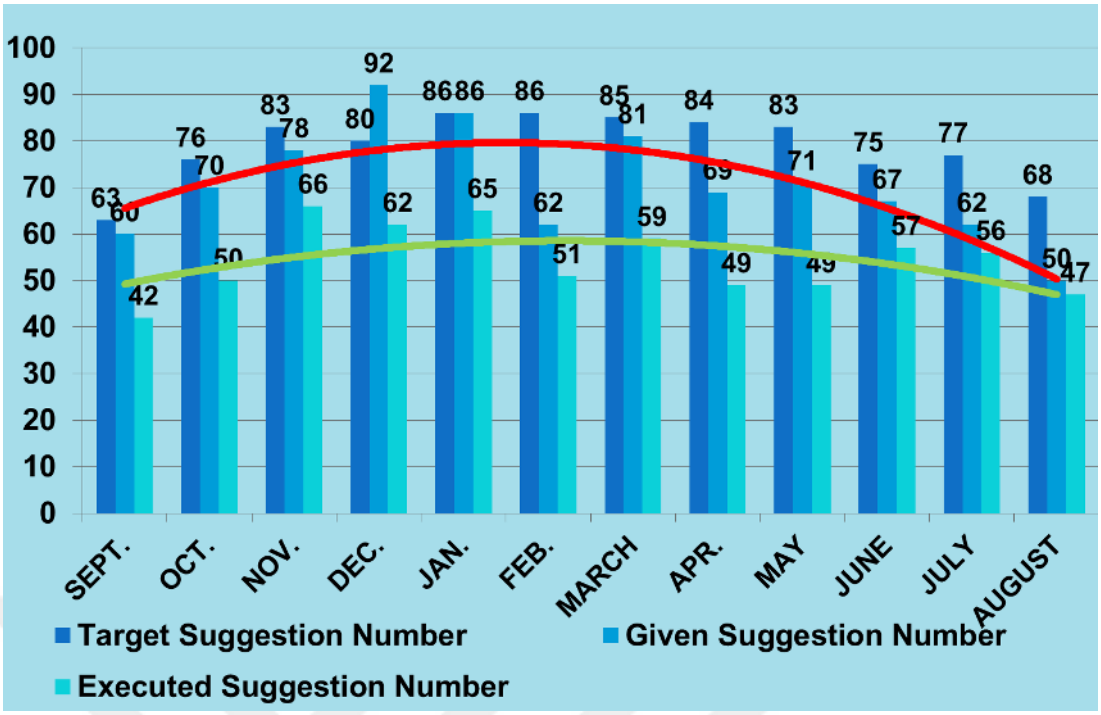

Figure 3.8 Other Kaizen suggestions distribution and Trend Graph of Field-1.

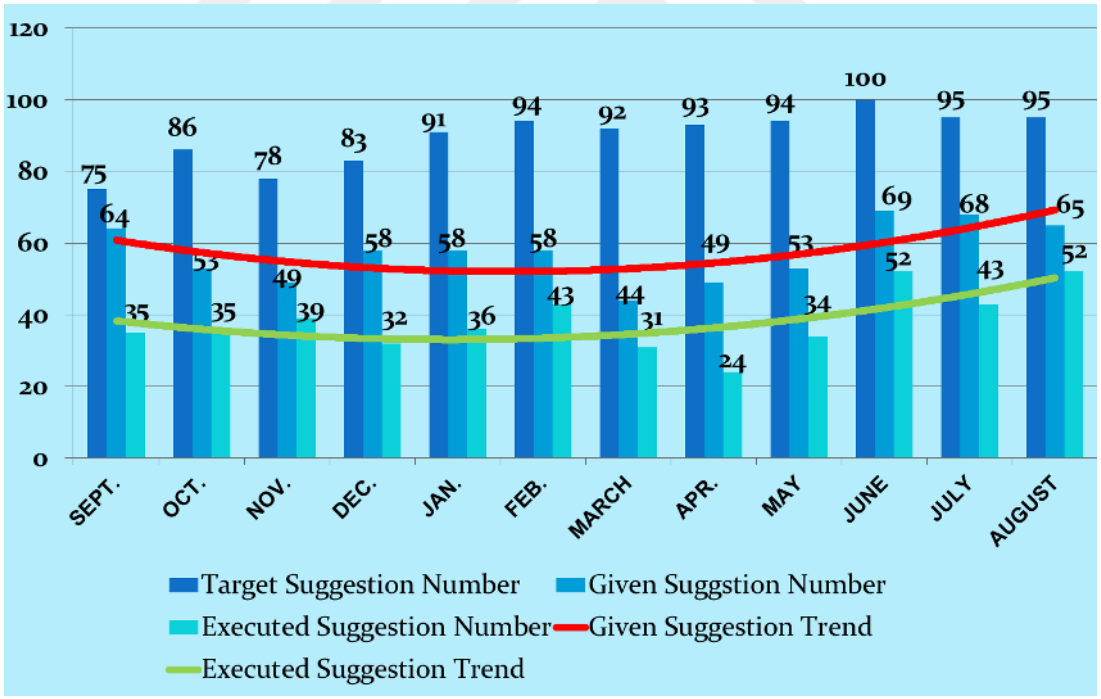

Figure 3.9 Other Kaizen suggestions distribution and Trend Graph of Field-2.

With the help of 5S seminars, applications, Kaizen seminars and applications 1 year occupational injury graph is shown in Figure 3.10.

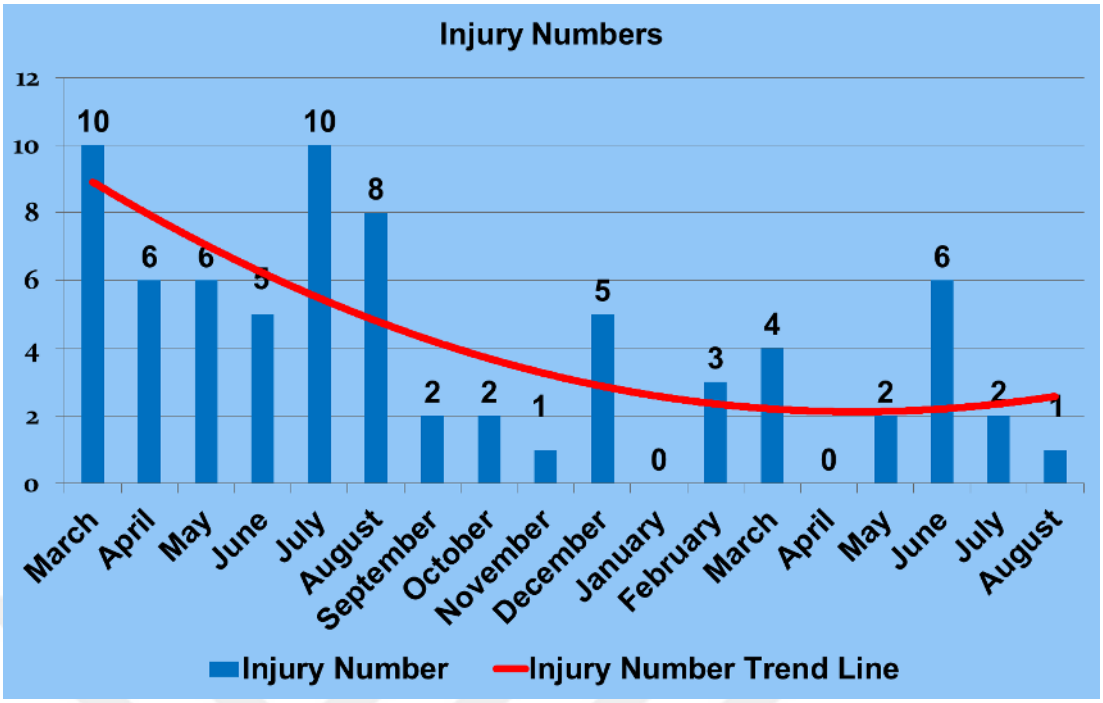

Figure 3.10 Occupational Injury numbers and trend.

Firstly team leader candidates were defined by management of factory and if team leaders have more than 70 points through 6 months these candidates became team leader. And they earn 250 TL team leadership compensation per month. At the end of 12 months period most of the colours are turned to blue or green as seen in Table 3.2. But in 6^{th} and 12^{th} months there are red boxes. The reason of that these months are salary increasing periods and if any team leader is not pleased with his increase he was giving reaction by not working well, so this was one of our motivation factor for doing this study. In Table 3.2 and Table 3.3 boxes are coloured according to Table 3.1.

Table 3.1 Box Colour Notation of Table 3.2 and Table 3.3

Score Range	Colour
91-100	Green
81-90	Blue
71-80	Yellow
61-70	Orange
0 -60	Red

Table 3.2 Team 5S Scores through 12 Months

TEAMS		TEAM MEMBERS	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST
PRODUCTION-ASSEMBLY	Hasan PEKTAŞ	11	90	86	78	59	79	77	81	77	85	98	90	87
	Mehmet BACAKSIZ	10	BECAME TLA ON DEC			66	83	75	69	78	90	97	95	92
	Yusuf GEZER	4	BECAME TLA ON NOV		95	70	87	78	78	86	90	95	97	92
	Adem YILMAZ	9	95	81	86	87	85	83	83	95	90	92	92	86
	Selahattin YİĞİT	8	67	66	64	67	78	72	82	87	70	71	93	75
	Barış KAHRAMAN	8	BECAME TLA ON DEC			59	92	85	85	97	90	97	97	90
	Hüseyin KILIÇ	9	BECAME TLA ON DEC			69	69	69	76	73	87	90	95	95
	Yılmaz BEKKİ		BECAME TLA ON JUNE									67	74	70
WELDING	Nahsen ÇELİK	12	BECAME TLA ON APRIL							67	70	70	90	92
	İsmail ÜZEN	12	BECAME TLA ON APRIL							69	69	95	97	84
CUTTING & BENDING	Ahmet KARAGÜLL EOĞLU	8	90	72	76	71	86	79	82	75	76	74	82	95
SUPPORT UNITS	Şahin SOLAK	8	BECAME TLA ON OCTOBER	76	92	87	67	75	75	74	67	72	69	67
MAINTENANCE	İlhan KIZILCIK	4	BECAME TLA ON APRIL							69	71	93	81	76
MACHINING	Tuncay SOLAK	7	76	67	69	80	67	74	72	70	77	59	72	67
									AVRG.	78	79	84	87	83

3.2 New Wages According to Work Analysis Results and 5S Scores

Work analysis studies are done for every predefined job, and their points and wages are calculated according to point method and geometric sequence. Then wage increments are done for each worker according to their 6 month average 5S points. In that 6 months period, teams of workers could be changed by team leaders due to labor requirement volatilities, so their average team points are independent from their existing team points. Average 5S team point of every worker is shown in Table 3.3. Then new wage calculations are shown in Table 3.4.

Table 3.3 Individual team 5S Scores through 6 months per worker.

	Worker Name and Surname	May	June	July	August	September	October	6 Months Average
1	ABDULBAKİ EMLİK	73	77	81	76	76	78	77
2	ABDULLAH SUNGUR	82	77	76	76	76	73	77
3	ABDULLAH ÇALIŞICI	66	75	63	60	60	65	65
4	ABDULLAH EKİNCİ	79	65	69	58	70	81	70
5	ABDURRAHMAN ATEŞ	67	86	81	93	83	96	84
6	ABDULMECİT YILDIRIM	72	64	73	60	69	74	69
7	ADEM ALMAS	77	63	63	72	74	74	71

8	ADEM YILMAZ	81	86	90	92	81	82	85
9	ADEM ÇOLAK	69	83	72	77	80	83	77
10	AHMET UÇAN	70	78	79	67	85	78	76
11	AHMET ASLAN	65	71	71	70	77	90	74
12	AHMET BAYRAM	74	62	68	On Duty	77	77	72
13	AHMET ŞAHİN	71	83	83	On Duty	77	78	78
14	AHMET MAT	69	64	78	75	83	81	75
15	ALİ YILDIRIM	83	86	92	87	80	97	88
16	ALİ İNKO	79	86	82	80	85	68	80
17	ALİ EKBER SOLAK	68	72	70	69	76	85	73
18	AYHAN ARSLAN	70	78	82	90	94	88	84
19	BARIŞ KAHRAMAN	88	98	98	85	91	97	93
20	BARIŞ YAĞIŞAK	73	76	80	65	83	70	75
21	BÜLENT ALTUN	79	87	89	81	92	65	82
22	BÜLENT KAPLAN	76	84	84	98	86	85	86
23	CAFER TAŞDELEN	70	73	93	85	87	75	81
24	CEMAL SONGUR	71	75	96	81	86	92	84
25	DAVUT KISACIK	63	69	69	75	76	74	71
26	DENİZ ATMACA	73	82	71	71	85	87	78
27	EKREM AKASLAN	71	63	63	66	74	65	67
28	EKREM KURT	66	55	72	60	60	74	65
29	ERCAN KAYAN	70	72	75	75	78	72	74
30	ERGÜN DURMUŞ	71	74	81	77	86	80	78
31	ERKAN DURAN	73	81	88	82	88	91	84
32	ERMAN DURAN	71	84	87	74	86	75	80
33	EROL ŞAHİN	74	74	80	72	82	75	76
34	ESER İPEKTEN	On Duty			68	88	92	83
35	EYUP KORKMAZ	66	55	63	60	69	69	64
36	FAZLI ÇEVİK	70	85	85	78	85	85	81
37	FERHAT KAYMAK	58	74	74	76	85	83	75
38	FERHAT DOĞUŞ DEMİR	79	87	84	77	87	59	79
39	GÖKHAN ŞAHİN	60	61	74	63	75	85	70
40	HACI KARAPUNAR	75	77	88	80	85	77	80
41	HACIALİ KILINÇ	76	79	80	70	73	82	77
42	HACI YUSUF ERDOĞAN	74	77	78	81	92	64	78
43	HALİL TOPLAR	83	80	86	91	86	83	85
44	HASAN HASTOPRAK	59	84	84	77	75	75	76
45	HASAN PEKTAŞ	80	99	78	77	81	77	82
46	HASAN YOLDAŞ	59	83	81	77	74	76	75
47	HASAN KARA	73	86	76	70	85	82	79
48	HÜSEYİN ÖZ	80	81	84	70	73	81	78
49	HÜSEYİN KILIÇ(Mehmet)	70	83	86	86	95	24	74
50	HÜSEYİN SUCU	67	73	79	87	82	77	78

51	HÜSEYİN KILIÇ(Muktat)	83	85	88	85	94	92	88
52	HÜSEYİN TOPLAR	65	73	83	76	96	84	80
53	İBRAHİM DENİZ	84	71	74	62	73	67	72
54	İBRAHİM KÖSE	68	82	88	79	85	75	80
55	İBRAHİM ÖZTÜRK(Vakkas)	66	83	83	71	93	71	78
56	İBRAHİM ÖZTÜRK(Bozan)	75	64	63	60	60	74	66
57	İBRAHİM HALİL KARAHAN	69	60	72	80	86	75	74
58	İHSAN ÜSTÜN	82	96	77	88	75	75	82
59	İLHAN KIZILCIK	62	85	75	68	90	92	79
60	İSMAİL ÜZEN	69	76	87	90	86	87	83
61	İSMAİL TAMER	72	81	87	73	85	78	79
62	KEMAL SOLAK	66	55	63	66	60	65	63
63	KEMAL İNAÇ	67	On Duty		58	81	70	69
65	MAHMUT KARABULUT	70	61	67	72	77	89	73
66	MECİT ALBAYRAM	68	83	78	86	85	75	79
67	MECİT YILDIRIM	83	94	98	86	97	92	92
68	MEHMET ALAGÖZ	64	60	60	71	66	86	68
69	MEHMET ASLAN	60	70	74	63	96	82	74
70	MEHMET BACAKSIZ	83	98	88	92	86	78	88
71	MEHMET DEMEZ	60	81	96	75	75	80	78
72	MEHMET DOĞAN	82	85	85	On Duty	83	85	84
73	MEHMET ERCAN	67	83	71	81	83	83	78
74	MEHMET KAHRAMAN	63	72	69	59	71	75	68
75	MEHMET KANDEMİR	69	88	78	87	81	73	79
77	MEHMET OKTAY	79	74	82	82	81	74	79
78	MEHMET TEKİN	72	82	85	78	84	73	79
79	MEHMET TOPLAR	70	70	86	67	83	77	76
80	MEHMET YILDIZHAN	76	84	84	78	92	85	83
81	MEHMET ALİ ÇOLAK	59	59	74	81	83	88	74
82	MEHMET VELİCAN TUZCU	69	74	78	64	77	88	75
83	MUHAMMET EMİN ZOR	On Duty			68	73	68	70
84	MUHARREM KARAOĞLAN	69	72	72	59	65	77	69
85	MUHARREM ŞIHTUĞ	75	81	71	66	74	75	74
86	MUHİTTİN PEKTAŞ	88	87	87	83	92	91	88
87	MURAT BIRAK	83	82	98	88	88	97	89
88	MURAT ASLAN	78	66	61	59	80	68	69
89	MURAT PARLAKYILDIZ	78	74	87	78	86	76	80
90	MURAT GAMSIZ	70	60	72	89	89	87	78
91	MUSA KAHRAMAN	88	87	87	92	92	80	88
92	MUSTAFA ERDOĞAN	71	73	89	69	86	93	80
93	MUSTAFA	80	82	85	75	85	72	80

	KESMEZOĞLU							
94	MUSTAFA DURAK	66	55	63	70	60	74	65
95	MUSTAFA ÖZTÜRK	On Duty			82	82	85	83
96	MUTLU GÖK	75	64	72	69	60	65	68
97	MUZAFFER TURAN	76	84	70	98	91	85	84
98	MİKAİL EYİBİLEN	72	95	95	83	88	92	88
99	MÜSLÜM ASLAN	71	84	81	66	80	78	77
100	MÜSLÜM EYİBİLEN	66	60	78	79	84	81	75
101	MÜSLÜM AĞCABAY	69	72	67	62	72	73	69
102	MÜSLÜM KARAKURT	83	86	79	76	80	85	82
103	NAHSEN ÇELİK	61	70	94	86	87	97	83
104	NECMİ KAYA	75	55	63	60	69	79	67
105	NEDİM KAYA	69	66	69	71	75	86	73
106	NİHAT HOŞGÖREN	67	84	77	76	84	74	77
107	NİZAMETTİN ARSLAN	69	85	73	70	76	81	76
108	ORHAN KAYA	71	84	69	59	71	91	74
109	OSMAN KARAOĞLAN	62	74	83	75	79	77	75
110	ÖKKEŞ DEMİR	72	76	72	72	75	75	74
111	ÖKKEŞ ŞEN ERDEMCİ	71	77	61	69	74	68	70
112	ÖMER BEKAR	61	86	77	79	86	97	81
113	Ö.MUSTAFA AĞBAYIR	80	83	78	73	75	85	79
114	REGAİP ŞAHİN	76	71	74	74	81	75	75
115	REMZİ BOZYİĞİT	69	69	69	75	71	69	70
116	SALİH ALP	68	76	77	70	76	63	72
117	SAİT DOĞAN	69	76	76	64	75	69	72
118	SAİT ATEŞ	73	73	82	73	81	93	79
119	SAİT KAYA	72	76	85	72	75	84	77
120	SELAHATTİN YİĞİT	72	62	80	71	94	91	78
121	SELİM ÇİĞİT	70	72	84	70	73	81	75
122	SERVET ÇELBİŞ	75	84	79	81	78	89	81
123	SERVET TÜRKAN	81	82	85	81	89	82	83
124	SEYFETTİN YEDİPINAR	66	55	63	60	60	65	62
125	SEYFULLAH BACAKSIZ	On Duty			71	77	67	72
126	ŞAHİN SOLAK	64	63	72	60	75	89	71
127	ŞIHLI DOĞAN	60	85	82	74	76	87	77
128	TALAT UZ	74	75	83	83	79	76	78
129	TALİP BULDUM	71	71	71	79	82	92	78
130	TAYFUN ŞAHİN	62	75	80	66	72	71	71
131	TUNCAY SOLAK	62	66	74	60	60	76	66
132	UĞUR KARABULUT	67	77	73	84	76	76	76
133	VAKKAS KARTAL	74	86	86	81	97	91	86
134	YAHYA YÜCEL	72	62	69	58	73	73	68
135	YUNUS EMRE DOĞAN	62	85	80	74	82	92	79
136	YUSUF GEZER	74	97	83	86	88	64	82
137	AHMET	65	75	83	81	83	76	77

	KARAGÜLLEOĞLU							
138	CEVDET ERGİN	69	60	81	87	86	79	77
139	MAHMUT UĞUR	66	78	73	81	80	83	77
140	MUSTAFA DERTLİ	71	55	72	60	60	65	64
141	NURİ KUŞ	57	57	74	80	81	77	71
142	NİHAT YILAN	58	70	81	78	78	79	74
143	YILMAZ BEKKİ	91	69	92	71	92	91	84
144	Y.KENAN ÇELİKTAŞ	On Duty				81	77	79
145	MUSTAFA DOĞAN	65	84	79	88	75	67	76
146	OSMAN MAT	76	84	79	89	77	90	83
147	İSTİKBAL GÖGÜŞ	On Duty				56	64	60
148	İ.HALİL DURGUT	62	62	80	75	77	77	72

Table 3.4 New wage calculations according to work analysis results unified with 5S scores.

No	Name	Surname	Job	Category	Job Score	Acutal Wage Based on Job Evaluation Results (TL)	5S Team Score (6 Month Av.)	Wage Increment Based on Present 5S Team Score (%)	Total New Wage (TL)
1	ADNAN	KIZILDAĞ	Factory Admin.	White Collar	648	15.000	-	-	15.000
2	LEVENT	AYDIN	Production Chief		638	11.052	-	-	11.052
3	ERHAN	YAMAKALİOĞLU	Production Chief		638	11.052	-	-	11.052
4	FAİK ÖZER	UÇAR	Project Chief		549	8.143	-	-	8.143
5	MUSA EREN	DOĞANGÜL	Project Chief		549	8.143	-	-	8.143
6	ARİF CAN	TEKE	Technical Drawer		335	4.421	-	-	4.421
7	SÜLEYMAN	ÖZKAYA	Technical Drawer		335	4.421	-	-	4.421
8	AHMET TURGUT	TEKKANAT	Inventory Stock Chief		325	3.257	-	-	3.257
9	MEHMET	BAŞAR	Compter Operator		318	2.400	-	-	2.400
10	RECEP	GÜNDÜZ	Quality Control Chief		487	6.000	-	-	6.000
11	MUSTAFA	HİNTOĞLU	Quality Control Chief		487	6.000	-	-	6.000
12	YUSUF	DAŞ	Mechanical Department Foreman	Blue Collar	504	3.195	-	-	3.195
13	İBRAHİM	ASLAN	Mechanical Department Foreman		504	3.195	-	-	3.195
14	TAHİR	YILAN	Mechanical Department		504	3.195	-	-	3.195

			Foreman					
15	CEMAL	SONĞUR	Electrical Maint. & Construction Ch.	270	2.349	78	3%	2.419
16	İLHAN	KIZILCIK	Mechanical Maint. & Construction Ch.	246	2.014	78	3%	2.074
17	İHSAN	ÜSTÜN	Cleaner	154	1.270	82	5%	1.334
18	AYHAN	ARSLAN	Cleaner	154	1.270	84	5%	1.334
19	HACİ	KARAPUNAR	Cleaner	154	1.270	80	5%	1.334
20	MUHARREM	KARAOĞLN	Cleaner	154	1.270	69	0%	1.270
21	EKREM	KURT	CNC Cutting Operator	239	1.727	65	0%	1.727
22	EKREM	AKASLAN	Milling Operator	245	1.865	67	0%	1.865
23	KEMAL	SOLAK	Milling Operator	245	1.865	63	0%	1.865
24	ABDULLAH	ÇALIŞICI	Milling Operator	245	1.865	65	0%	1.865
25	EYUP	KORKMAZ	Milling Operator	245	1.865	64	0%	1.865
26	MUSTAFA	DURAK	Milling Operator	245	1.865	65	0%	1.865
27	MUSTAFA	DERTLİ	Milling Operator	245	1.865	64	0%	1.865
28	MUTLU	GÖK	Turning Operator	238	1.599	68	0%	1.599
29	ABDÜLMECİT	YILDIRIM	Turning Operator	238	1.599	69	0%	1.599
30	SAİT	ATEŞ	Turning Operator	238	1.599	79	3%	1.647
31	İBRAHİM	ÖZTÜRK (Bozan oğlu)	Turning Operator	238	1.599	66	0%	1.599
32	NECMİ	KAYA	Turning Operator	238	1.599	67	0%	1.599
33	ERKAN	DURAN	Turning Operator	238	1.599	84	5%	1.679
34	SEYFETTİN	YEDİPINAR	Turning Operator	238	1.599	62	0%	1.599
35	MUSTAFA	ÖZTÜRK	Turning Operator	238	1.599	83	5%	1.679
36	AHMET	KARAGÜLLEOĞLU	CNC Cutting Operator	239	1.727	77	3%	1.779
37	ORHAN	KAYA	Bending Operator	284	2.740	74	3%	2.822
38	TALAT	UZ	CNC Cutting Operator	239	1.727	78	3%	1.779
39	ÖKKEŞ ŞEN	ERDEMCİ	CNC Cutting Operator	239	1.727	70	0%	1.727
40	AHMET	MAT	Cleaner	154	1.270	75	3%	1.308

41	NİHAT	HOŞGÖREN	Painter	197	1.371	77	3%	1.412
42	MEHMET	KAHRAMAN	Cleaner	154	1.270	68	0%	1.270
43	KEMAL	İNAÇ	Cleaner	154	1.270	69	0%	1.270
44	Yusuf Kenan	Çeliktaş	Painter	197	1.371	79	3%	1.412
45	SEYFULLAH	BACAKSIZ	Painter	197	1.371	72	3%	1.412
46	İSMAİL	ÜZEN	Welder	323	2.959	83	5%	3.107
47	NAHSEN	ÇELİK	Welder	323	2.959	83	5%	3.107
48	TALİP	BULDUM	Welder	323	2.959	78	3%	3.048
49	ESER	İPEKTEN	Welder	323	2.959	83	5%	3.107
50	MAHMUT	KARABULUT	Welder	323	2.959	73	3%	3.048
51	MEHMET	ALAGÖZ	Welder	323	2.959	68	0%	2.959
52	FAZLI	ÇEVİK	Welder	323	2.959	81	5%	3.107
53	NEDİM	KAYA	Welder	323	2.959	73	3%	3.048
54	ŞIHLI	DOĞAN	Welder	323	2.959	77	3%	3.048
55	MEHMET	DEMEZ	Welder	323	2.959	78	3%	3.048
56	REMZİ	BOZYİĞİT	Welder	323	2.959	70	0%	2.959
57	MEHMET	ERCAN	Welder	323	2.959	78	3%	3.048
58	CAFER	TAŞDELEN	Welder	323	2.959	81	5%	3.107
59	MURAT	GAMSIZ	Welder	323	2.959	78	3%	3.048
60	NİZAMETTİN	ARSLAN	Welder	323	2.959	76	3%	3.048
61	NURİ	KUŞ	Welder	323	2.959	71	3%	3.048
62	CEVDET	ERGİN	Welder	323	2.959	77	3%	3.048
63	NİHAT	YILAN	Welder	323	2.959	74	3%	3.048
64	MÜSLÜM	EYİBİLEN	Welder	323	2.959	75	3%	3.048
65	M. ALİ	ÇOLAK	Welder	323	2.959	74	3%	3.048
66	HASAN	YOLDAŞ	Welder	323	2.959	75	3%	3.048
67	HASAN	HASTOPRAK	Welder	323	2.959	76	3%	3.048
68	HÜSEYİN	TOPLAR	Welder	323	2.959	80	5%	3.107
69	ÖMER	BEKAR	Welder	323	2.959	81	5%	3.107
70	HÜSEYİN	SUCU	Welder	323	2.959	78	3%	3.048
71	AHMET	ASLAN	Welder	323	2.959	74	3%	3.048
72	ERGÜN	DURMUŞ	Welder	323	2.959	78	3%	3.048
73	UĞUR	KARABULUT	Welder	323	2.959	76	3%	3.048
74	İ. HALİL	KARAHAN	Welder	323	2.959	74	3%	3.048
75	DAVUT	KISACIK	Welder	323	2.959	71	3%	3.048
76	AHMET	BAYRAM	Welder	323	2.959	72	3%	3.048
77	MÜSLÜM	AĞCABAY	Welder	323	2.959	69	0%	2.959
78	Ö.MUSTAFA	AĞBAYIR	Welder	323	2.959	79	3%	3.048
79	VAKKAS	KARTAL	Welder	323	2.959	86	5%	3.107
80	DENİZ	ATMACA	Welder	323	2.959	78	3%	3.048
81	FERHAT	KAYMAK	Welder	323	2.959	75	3%	3.048
82	İ. HALİL	DURĞUT	Welder	323	2.959	72	3%	3.048
83	YILMAZ	BEKKİ	Assembly Expert	250	2.175	84	5%	2.284
84	MİKAİL	EYİBİLEN	Assembly Expert	250	2.175	88	5%	2.284
85	ADEM	YILMAZ	Assembly Expert	250	2.175	85	5%	2.284

86	HASAN	PEKTAŞ	Assembly Expert	250	2.175	82	5%	2.284
87	MÜSLÜM	KARAKURT	Assembly Expert	250	2.175	82	5%	2.284
88	ALİ	YILDIRIM	Assembly Expert	250	2.175	88	5%	2.284
89	MECİT	YILDIRIM	Assembly Expert	250	2.175	92	7%	2.327
90	SELAHATTİN	YİĞİT	Assembly Expert	250	2.175	78	3%	2.240
91	YUSUF	GEZER	Assembly Expert	250	2.175	82	5%	2.284
92	HÜSEYİN	KILIÇ (Mehmet Oğlu)	Assembly Expert	250	2.175	74	3%	2.240
93	BARIŞ	KAHRAMAN	Assembly Expert	250	2.175	93	7%	2.327
94	MEHMET	BACAKSIZ	Assembly Expert	250	2.175	88	5%	2.284
95	HÜSEYİN	KILIÇ (Muktat Oğlu)	Assembly Expert	250	2.175	88	5%	2.284
96	HACİ ALİ	KILINÇ	Assembly Expert	250	2.175	77	3%	2.240
97	MEHMET	TEKİN	Assembly Expert	250	2.175	79	3%	2.240
98	MUHARREM	ŞIHTUĞ	Turning Operator	238	1.599	74	3%	1.647
99	İBRAHİM	ÖZTÜRK	Turning Operator	238	1.599	78	3%	1.647
100	MEHMET	OKTAY	Turning Operator	238	1.599	79	3%	1.647
101	MUSTAFA	ERDOĞAN	Turning Operator	238	1.599	80	5%	1.679
102	HALİL	TOPLAR	Turning Operator	238	1.599	85	5%	1.679
103	ALİ	İNKO	Turning Operator	238	1.599	80	5%	1.679
104	MUHİTTİN	PEKTAŞ	Turning Operator	238	1.599	88	5%	1.679
105	MUSTAFA	KESMEZOĞLU	Turning Operator	238	1.599	80	5%	1.679
106	SERVET	TÜRKAN	Turning Operator	238	1.599	83	5%	1.679
107	HACİ YUSUF	ERDOĞAN	Turning Operator	238	1.599	78	3%	1.647
108	MEHMET	DOĞAN	Turning Operator	238	1.599	84	5%	1.679
109	AHMET	ŞAHİN	Cleaner	154	1.270	78	3%	1.308
110	ERMAN	DURAN	Cleaner	154	1.270	80	5%	1.334
111	HASAN	KARA	Cleaner	154	1.270	79	3%	1.308
112	ADEM	ÇOLAK	Cleaner	154	1.270	77	3%	1.308

113	FERHAT DOĞUŞ	DEMİR	Cleaner	154	1.270	79	3%	1.308
114	MUSA	KAHRAMAN	Cleaner	154	1.270	88	5%	1.334
115	ABDULLAH	EKİNCİ	Cleaner	154	1.270	70	0%	1.270
116	M.VELİCAN	TUZCU	Cleaner	154	1.270	75	3%	1.308
117	BARIŞ	YAĞIŞAK	Cleaner	154	1.270	75	3%	1.308
118	ÖKKEŞ	DEMİR	Cleaner	154	1.270	74	3%	1.308
119	ABDULBAKİ	EMLİK	Cleaner	154	1.270	77	3%	1.308
120	İBRAHİM	KÖSE	Cleaner	154	1.270	80	5%	1.334
121	İSMAİL	TAMER	Cleaner	154	1.270	79	3%	1.308
122	MURAT	ASLAN	Cleaner	154	1.270	69	0%	1.270
123	AHMET	UÇAN	Cleaner	154	1.270	76	3%	1.308
124	GÖKHAN	ŞAHİN	Cleaner	154	1.270	70	0%	1.270
125	EROL	ŞAHİN	Cleaner	154	1.270	76	3%	1.308
126	MURAT	PARLAKYILDIZ	Cleaner	154	1.270	80	5%	1.334
127	BÜLENT	ALTUN	Cleaner	154	1.270	82	5%	1.334
128	SAİT	DOĞAN	Cleaner	154	1.270	72	3%	1.308
129	YAHYA	YÜCEL	Cleaner	154	1.270	68	0%	1.270
130	MEHMET	KANDEMİR	Cleaner	154	1.270	79	3%	1.308
131	İBRAHİM	DENİZ	Cleaner	154	1.270	72	3%	1.308
132	MÜSLÜM	ASLAN	Cleaner	154	1.270	77	3%	1.308
133	SERVET	ÇELBİŞ	Cleaner	154	1.270	81	5%	1.334
134	ABDULLAH	SUNGUR	Cleaner	154	1.270	77	3%	1.308
135	MEHMET	TOPLAR	Cleaner	154	1.270	76	3%	1.308
136	MEHMET	ASLAN	Cleaner	154	1.270	74	3%	1.308
137	TAYFUN	ŞAHİN	Cleaner	154	1.270	71	3%	1.308
138	SELİM	ÇİĞİT	Cleaner	154	1.270	75	3%	1.308
139	OSMAN	KARAOĞLAN	Cleaner	154	1.270	75	3%	1.308
140	ERCAN	KAYAN	Cleaner	154	1.270	74	3%	1.308
141	M. EMİN	ZOR	Cleaner	154	1.270	70	0%	1.270
142	SAİT	KAYA	Cleaner	154	1.270	77	3%	1.308
143	SALİH	ALP	Cleaner	154	1.270	72	3%	1.308
144	HÜSEYİN	ÖZ	Cleaner	154	1.270	78	3%	1.308
145	REGAİP	ŞAHİN	Cleaner	154	1.270	75	3%	1.308

CHAPTER 4

DISCUSSIONS AND CONCLUSIONS

Determining the importance and difficulty of jobs in business and determining the wage to be paid to employees is one of the most important issues for both business managers and employees.

Job evaluation is a system that enables businesses to examine the jobs separately and in detail and as a result, determines the importance of jobs for business.

Job evaluation methods are divided into two as analytical and non-analytical methods. Non-analytical job evaluation methods are Ranking and Job Grading methods. Analytical job evaluation methods are Factor Comparison and Point-Ranking methods. It is appropriate to use non-analytical job evaluation methods in small and medium-sized enterprises with little or no job diversity. As job diversity increases, it is more appropriate to apply analytical job evaluation methods.

Within the scope of the study, Point-Ranking Method applied in Çiltuğ Heat Industry and Trade Inc. In the first phase of the application, job evaluation factors were chosen as responsibility, skill, mental effort, physical effort, and environmental conditions. Under these five main factors, 18 sub-factors were evaluated. Then these factors were defined and scored. We acted according to the following principles in scoring the factors: who know the job best, who does the work. The factors were weighted in the light of the opinions of the managers of all departments for which job evaluation was planned. After weighting, the score of each factor grade was calculated by using the AHP method. The job evaluation system obtained after these procedures were applied by using observation and interview techniques. The scores of the jobs were obtained with the job evaluation application by classifying and 20 workgroups were determined upon the request of the business managers.

5S and KAIZEN tools of lean production were used in order to determine and compare the performance of the employees. Thanks to these tools, the organization became better organized and tidy, and employees were better owned their jobs to make better performance. Performance evaluations were done with the obtained performance outputs. In order to prevent unrest in the employees, the level of performance is reflected in the wage system in detail. In this way, the performance level in job evaluation is considered as an evaluation factor and also evaluated in the wage model.

Consequently, a new wage model has been developed by using the performance scores obtained from the application of the 5S and KAIZEN tools of lean production. In the wage model, both job evaluation results and lean manufacturing performance scores were included, this is a novel and innovative approach for lean management. In this way, both employees' unrest in this issue was achieved and the budget allocated for the labor force was distributed fairly among the employees and the demands of the managers were met. However, since lean manufacturing applications were applied only among blue-collar personnel, the lean manufacturing performance scores were not included in the wage calculations of white-collar workers. With the new wage systematic, all wages became explicable.

With this study, employees had more hearing over the business and had more attributes to improve the business. So in this way, a more democratic medium is constituted in the factory. Prior to this study, only the potential of the white-collar had been utilized to improve and manage the business, and after that, the potential of all the personnel started to be utilized. Employees started to work in more humane conditions by providing a safer, cleaner and more regular working area with 5S studies, KRKs and Kaizen recommendations given and realized. This is also explained by the number of occupational accidents reached at the end of one year.

This study brings together the subjects of job analysis and evaluation and lean manufacturing issues, which have never seen to be used together. As suggested in the previous studies, the performance evaluation criterion is also included in the wage evaluation system [87, 106].

Suggestions for future studies;

1. Performance results from the implementation of other tools of lean production can also be included in the wage assessment system.
2. Work experience (seniority) can also be added as wage assessment criteria.
3. Different job analysis methods can also be used for job evaluation.
4. This application can be applied to project-based enterprises and the results can be discussed.
5. A decision support system can be prepared to support factor scoring in job evaluation studies.
6. A more detailed wage system can be obtained by considering the different criteria that may be needed.
7. A new study evaluating the results of this and other studies in terms of cultural differences can be made.

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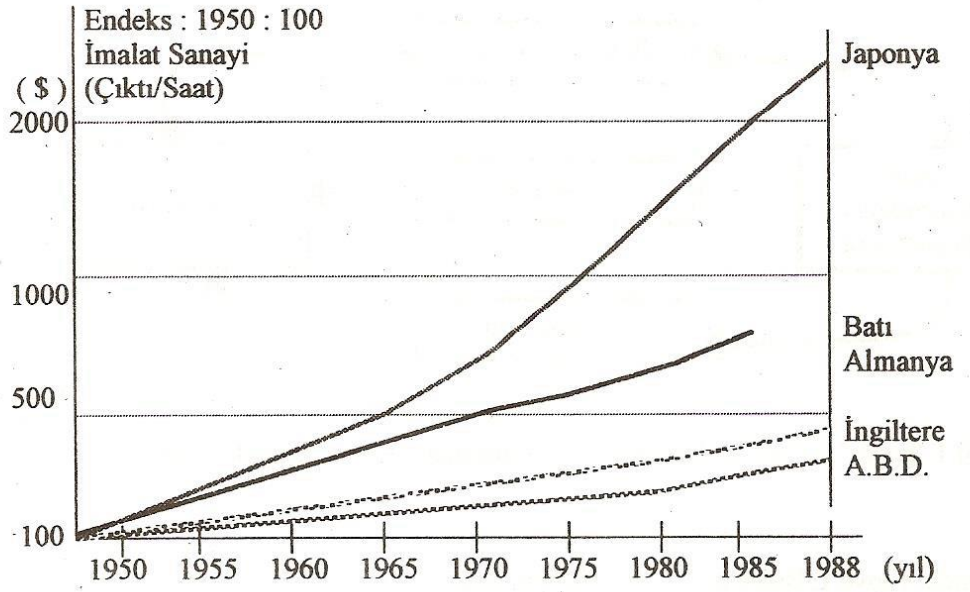
APPENDICES

APPENDIX 1. Change in Productivity Rates in Manufacturing Industry [107]



APPENDIX 2. Sample Work Analysis Form

WORK ANALYSIS FORM (EXAMPLE)

Administration :

Department :

Place :

Job Name :

Person Name :

Number :

Analysts :

1) Information about task

Summary of work: Work definition is explained in one or two sentences. (Scope of work and how work is done)

Tasks: Each one of works is task. Used time is designated. Also, it includes how work is done.

Fundamental Tasks

% 1)

% 2)

Periodic Tasks

% 1)

% 2)

2) Necessary minimum attributes for work is done

Education level: Stipulated for achieved necessary skill (such as foreign language learning, logical operations, mathematical operations etc.) is education duration.

Special Abilities

- Sensetive working
- Learning fast
- Giving sudden decisions
- Body Ability

Occupational preparation: It includes situation such as occupational education, apprenticeship education, experience, in service and ago service education. (Being working to same work branch previously)

Responsibility: For example, product and equipment responsibility, financial responsibility.

Used work tool: Tools used for work are designated.

Foreign language: Level of foreign language used for work

3) Organizational Relations

Management: Title and number of existing under command and surveillance are designated.

Relations by other tasks: Tasks which can get promotion to this task and of this task are designated.

Mental effort: Mental skills include cases as interpreted of complex data and opinions and struggled different situations and persuasion ability etc.

Coordination	Collaboration
Attention	Memory
Observation	Control

4) Necessery Effort for Task

5)

Physical effort: Duration and type of the physical working and sitting or standing working position. Passing duration to sitting, standing, moving and other shapes of working duration are designated to be percentage.

Standing %, Sitting%, Moving%, Other%

Body Effort

Carrying weight Walking

Hand motions Arm motions

Leg and body motions Crouching

Turning

Working conditions: Working condition which is such as cold, hot, noisy environment etc…

Heat Air current

Coldness Light

Dust Noise

Smoke Gas

Burning and combustible material Occupational disorders

Radiation

Work danger: Situation such as being work accident

Burning Cutting

Crushing Electric shock

Lifting under weight Permanent damage in body

APPENDIX 3. Job Descriptions

These are descriptions of staffs' jobs at Çiltuğ. The following statements are intended to describe the general nature and level of work being performed. They are not intended to be construed as an exhaustive list of all responsibilities, duties and skills required of personnel so classified.

Job Title: PROJECT CHIEF

SUMMARY:

Under general supervision, plans, organizes, and coordinates the projects. Prepares bills of materials, preparing technical drawings and controlling them. Also technical consulting, project planning, on-site coordination, contractor oversight, quality control with non-destructive examination tests, and contract management.

DUTIES AND RESPONSIBILITIES:

7. Prepares bill specifications, obtains material lists, and develops project plans and estimates.
8. Directs and oversees projects, coordinating with and serving as between departments and contractors, to ensure that deadlines are met, and that projects comply with specifications, policies, regulations, and codes.
9. Inspects, approves, and accepts completed projects.
10. Orders equipment and services as appropriate.
11. Conducts presentations on project issues for management.
12. Collects and analyzes data; prepares scheduled and special reports; maintains program/project records and statistical information.
13. Quality control by doing liquid penetration and ultrasonic tests.

MINIMUM JOB REQUIREMENTS:

Bachelor's degree (university gradutation degree) with 6 years experience directly related to the duties and responsibilities specified.

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

- Analytical approach.
- Ability of work with a team.
- Ability to analyze and develop appropriate systems and/or services solutions.
- Strong interpersonal and communication skills and the ability to work effectively with a wide range of constituencies in a diverse community.
- Knowledge and understanding of advanced systems, equipment, and services.
- Ability to gather and analyze data and generate reports.
- Knowledge of current technological developments/trends in area of expertise.
- Knowledge of analysis techniques.
- Ability to communicate effectively, both orally and in writing.
- Knowledge of principles, procedures, regulations, and standards.
- Ability to develop and deliver presentations.
- Ability to develop project projections.

WORKING CONDITIONS AND PHYSICAL EFFORT:

- Work is normally performed in a typical interior/office work environment.
- No or very limited physical effort required in office work but so much in work environment.
- No or very limited exposure to physical risk in office environment but so many risks about falling, crashing, cutting, electrical shock and temproray disorders in body.

Job Title: WELDER

SUMMARY:

Designs, fabricates, joins and repairs equipment, fixtures and structures by using various welding techniques.

DUTIES AND RESPONSIBILITIES:

This is a journey level job classification and is first in a series of two classifications. It is distinguished from the Welder, Lead classification which is comprised of certified welders with a broader base of welding expertise who are proficient in the

design, fabrication, joining and/or repair of space age metals, scientific and research components. Welders are called upon to lift and carry heavy objects, and work under conditions of restricted movement, a dirty environment, air contamination, intense noise, and hazardous materials.

- Designs, fabricates, joins and/or repairs equipment, fixtures and various types of metal objects and structures using oxygen-acetylene, electric arc, MIG and TIG welding techniques.

- Operates drill presses, power saws, grinders, metal lathes and a variety of welding equipment and hand tools.

- Analyzes plans, drawings, work samples, specifications and work orders to determine work requirements and sequence of welding assignments.

- Estimates material and labor.

- Recommends supplies and materials to be ordered.

- May operate various snow removal equipment.

MINIMUM JOB REQUIREMENTS:

- Six years of welding experience; OR,

- Completion of an accredited four year welder's training program; OR,

- Completion of an accredited two year welder's training program AND two years of welding experience; OR,

- Any equivalent combination of experience, training and/or education approved by Human Resources.

- Possession of a current Arizona Type D driver's license upon employment.

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

- Knowledge of applicable codes.

- Knowledge of welding techniques (oxygen-acetylene, electric arc, and TIG), tools and equipment.

- Skill in the design, fabrication, joining and repair of a variety of metal objects, equipment, fixtures and structures. Ability to effectively communicate.

Job Title: COMPUTER OPERATOR

SUMMARY:

Under general supervision, operates and monitors mainframe and mid-range computer and equipment, such as printers, tape and disk drives, in an environment requiring continuous shift coverage. Selects and loads input and output, observes operation of equipment, control panels, error lights, verification printouts, error messages, and faulty output. Researches error messages and may manipulate console To resequence job steps after a job is interrupted.

DUTIES AND RESPONSIBILITIES:

1. Initializes computer with required system software and operates computer system as directed.
2. Monitors computer and network systems using operating systems utilities; interprets console messages from system software or applications program, and performs required actions.
3. Performs daily backup of systems.
4. Handles input and output media with due care for integrity of data and utility of media for subsequent use.
5. Maintains records required to supplement console log, including problem documentation and actions taken, computer utilization logs, file identification, and similar data.

MINIMUM JOB REQUIREMENTS:

High school diploma or GED; at least 1 year of experience that is directly related to the duties and responsibilities specified.

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

- Records maintenance skills.
- Ability to initialize and operate computer hardware and software systems.
- Ability to utilize computer operating systems utilities.
- Knowledge of computer systems backup requirements and procedures.
- Knowledge of computer input and output media.
- Ability to document work in progress.
- Knowledge of current technological developments/trends in area of expertise.
- Knowledge of computer job control procedures.
- Database management skills.
- Ability to analyze and solve problems.
- Ability to work weekends and/or various shift rotations as required.
- Ability to determine the nature of computer hardware and systems software problems, and to communicate technical guidance and information to users.

DISTINGUISHING CHARACTERISTICS:

Position requires: a) Operating and monitoring computers, printers, tapes and disk drives; b) observing equipment, control panels, error lights and messages, and faulty output; c) performing daily system backups

WORKING CONDITIONS AND PHYSICAL EFFORT:

- Work is normally performed in a typical interior/office work environment.
- Light physical effort. Requires handling of average-weight objects or some standing or walking. Effort applies to no more than two (2) hours per day.
- No or very limited exposure to physical risk.

Job Title: DEPARTMENT ADMINISTRATOR (Factory Administrator)

SUMMARY:

Under general supervision, manages the administrative functions of the factory as measured by criteria including, but not limited to, number of factory and staff employees, annual budgets and expenditures, number of active accounts, and number of research and/or revenue generating programs. Oversees fiscal and budgetary

management, human resource administration, facilities and resource management, coordination of contract and grant efforts, development and implementation of operational procedures, and special projects. Serves as advisor to factory head.

DUTIES AND RESPONSIBILITIES:

1. Manages daily administrative operations of the organization; provides direct supervision to subordinate employees including planning, assigning, and organizing work; interviews, hires, and trains support personnel.
2. Oversees and coordinates the fiscal activity of the department, to include participation in development and management of operating budgets, contracts and/or grants administration (as applicable), inventory management, payroll administration, travel, purchasing, and/or distributions; reviews and reconciles monthly ledgers and reports for unit accounts, and assists with departmental fiscal planning.
3. Coordinates special department activities, including conferences, workshops, graduation, and other similar functions.
4. May provide administrative support and direction to the instructional, research, and service programs of the department including those at satellite locations.
5. May coordinate environmental health and safety programs for the department; may oversee building maintenance, space assignments, vehicle fleet operations, security, and other related matters.
6. May serve on various policy-making committees.
7. May assist with the administrative components of the graduate and undergraduate student selection and admission process, including routine student advisement, review of transcripts, and problem resolution related to curriculum and course prerequisites.
8. May coordinate activities for ordering textbooks, including desk copies, and developing the schedule of courses, classrooms, and laboratories.
9. Performs miscellaneous job-related duties as assigned.

MINIMUM JOB REQUIREMENTS:

University diploma ; Directly related management expertise in fiscal services, administration, and human resources gained through either 2 years of equivalent-level work experience.
At least 1 year of additional work experience that can be demonstrated to be applicable to the duties listed on the job description.

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

- Ability to supervise and train employees, to include organizing, prioritizing, and scheduling work assignments.
- Knowledge of project management principles, practices, techniques, and tools.
- Strong interpersonal and communication skills and the ability to work effectively with a wide range of constituencies in a diverse community.
- Ability to gather data, compile information, and prepare reports.
- Skill in examining and re-engineering operations and procedures, formulating policy, and developing and implementing new strategies and procedures.
- Skill in budget preparation and fiscal management.
- Ability to communicate effectively, both orally and in writing.

WORKING CONDITIONS AND PHYSICAL EFFORT:

- Work is normally performed in a typical interior/office work environment.
- No or very limited physical effort required.
- No or very limited exposure to physical risk.

Job Title: Technical Drawer

SUMMARY:

Under general supervision, designs and/or coordinates the development and design of a wide range of electronic and/or printed graphic materials, involving a variety of integrated steps and processes, and requiring extensive knowledge of specialized, multi-faceted design concepts and media. Creates complex, original graphic design

and comprehensive layout concepts, and oversees and coordinates production of materials. May lead and guide the work of graphic designers and/or students.

DUTIES AND RESPONSIBILITIES:

1. Conceptualizes, plans, designs, and produces a wide range of specialized graphic and/or illustrative material, to include multimedia concepts, as appropriate.
2. Works with clientele to ascertain needs and to develop graphic directions, concepts, and specifications for assigned projects.
3. Plans production schedules for the various steps in the design process; analyzes and projects development costs and develops project budgets and workflow.
4. Identifies, selects, and coordinates vendors for printing and publication services, as appropriate to the project; may write and process requests for proposals for printing requisitions; identifies and recommends contractors, such as typesetters, printers, illustrators, photographers, and/or cartographers.
5. Oversees and coordinates the production process; develops and writes printing and/or other production specifications, and selects appropriate production media and materials, such as ink and paper; inspects proofs for accuracy and adherance to appropriate production standards.
6. Provides technical advice and guidance, and serves as liaison with production personnel, authors, publishers, clients, and/or printing representatives on design and technical graphics issues.
7. Participates in production and/or marketing planning group sessions and meetings, on a project basis.
8. Writes and edits basic copy, as appropriate, which may include press releases in some instances.
9. May coordinate a graphics or photographic library and/or maintain digital records.
10. May provide technical computer support and install software programs.
11. May create and produce animated videos and animated portions of live videos using computers and video production equipment.
12. May supervise and/or lead lower graded staff and/or student employees.
13. Performs miscellaneous job-related duties as assigned.

MINIMUM JOB REQUIREMENTS:

High school diploma or GED; at least 5 years of experience that is directly related to the duties and responsibilities specified.

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

- Knowledge of principles and practices of graphic design.
- Ability to create and produce graphic materials using a range of media, methods, techniques, and equipment.
- Ability to identify and interpret graphic design needs and develop creative and responsive design concepts.
- Ability to communicate effectively, both orally and in writing.
- Ability to develop complex, integrated design, printing, and/or reproduction specifications.
- Ability to compile and prepare graphic production budgets, schedules, and workplans.
- Knowledge of available external graphic design, printing, publication, and associated resources.
- Knowledge of printing and/or reproduction processes and techniques.
- Knowledge of graphic layout and photographic requirements and procedures.
- Ability to supervise and train assigned staff.

DISTINGUISHING CHARACTERISTICS:

Position requires: a) Creating complex, original graphic design and comprehensive layout concepts; b) planning of production schedules including costing and workflow assignment; c) identifying, selecting, and coordinating vendors for printing services; d) coordinating production specifications including necessary materials and services; and e) providing technical advice and guidance, and serving as liaison with production personnel.

WORKING CONDITIONS AND PHYSICAL EFFORT:

- Work is normally performed in a typical interior/office work environment.
- No or very limited physical effort required.
- No or very limited exposure to physical risk

Job Title: MAINTENANCE AND CONSTRUCTION CHIEF

SUMMARY:

Under general direction, oversees planning, development, coordination, implementation, and management of maintenance, repair, and repairs and maintenance of factory infrastructure systems, including domestic water, gas, electrical, sanitary, sewer, and storm drainage systems. Provides strategic planning of renewal of the built factory environment, and oversees review of capital construction plans for compliance with quality, durability, maintainability, and cost standards.

DUTIES AND RESPONSIBILITIES:

1. Oversees the supervision of personnel, which includes work allocation, training, and problem resolution; evaluates performance and makes recommendations for machine actions; motivates employees to achieve peak productivity and performance.
2. Participates in the management of operating and capital budgets.
3. Develops and executes monthly maintenance plans in conjunction with special events calendars; directs seasonal facilities support activities, including off-season overhauls of heating, air conditioning, and ventilation systems and environmental system conversions.
4. Ensures contractor code compliance by directing engineering project inspection programs; performs plan reviews in coordination with facility planning; develops remedial action programs as appropriate.
5. Develops and implements systems and processes to establish and maintain records for the operating unit.

MINIMUM JOB REQUIREMENTS:

High school diploma or GED; at least 5 years of experience that is directly related to the duties and responsibilities specified.

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

- Ability to direct multi-department technical and administrative staff.

- Ability to supervise and train employees, to include organizing, prioritizing, and scheduling work assignments.
- Skill in the use of personal computers and related software applications.
- Knowledge of organizational structure, workflow, and operating procedures.
- Skill in organizing resources and establishing priorities.

WORKING CONDITIONS AND PHYSICAL EFFORT:

- Work is normally performed in a typical interior/office work environment.
- No or very limited physical effort required.
- No or very limited exposure to physical risk.

Job Title: TURNING OPERATOR

SUMMARY:

Set up, operate, or tend lathe and turning machines to turn, bore, thread, form, or face metal or plastic materials, such as wire, rod, or bar stock.Realistic occupations frequently involve work activities that include practical, hands-on problems and solutionsMany of the occupations require working outside, and do not involve a lot of paperwork or working closely with others.

DUTIES AND RESPONSIBILITIES:

1. Moves controls to set cutting speeds and depths, and feed rates and to position tool in relation to workplace.

2. Cranks machine through cycle, stopping to adjust tool positions and machine controls, to ensure specified timing, clearance, and tolerances.

3. Installs holding fixtures, cams, gears, and stops to control stock and tool movement, using hand tools, power tools, and measuring instruments.

4. Selects cutting tools and tooling instructions, according to knowledge of metal properties and shop mathematics, or written specifications.

5. Observes operation and stops machine to inspect finished workpiece and verify conformance with specifications of first-run, using measuring instruments.

6. Studies blueprint, layout, or chart, to visualize work and determine materials needed, sequence of operations, dimensions, and tooling instructions.

7. Lifts metal stock or workpiece manually or using hoist, and positions and secures it

MINIMUM JOB REQUIREMENTS:

Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. The college search results are undergraduate programs associated with Lathe and Turning Machine Tool Setters, Operators. Further education may also be required to pursue this career.

The training search results include both short and long-term programs associated with Lathe and Turning Machine Tool Setters, Operators, and may be more appropriate for adult and non-traditional students. Further training may also be required to pursue this career.

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

Determining the kind of tools and equipment needed to do a job.Installing equipment, machines, wiring, or programs to meet specifications.Using mathematics to solve problems.Controlling operations of equipment or systems.Conducting tests and inspections of products, services, or processes to evaluate quality or performance. Analyzing needs and product requirements to create a design.Watching gauges, dials, or other indicators to make sure a machine is working properly.Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.Knowledge of machines and tools, including their designs, uses, repair, and maintenance.Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.Knowledge of design techniques, tools, and principles involved in production of precision technical

plans, blueprints, drawings, and models.Knowledge and prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub-atomic structures and processes.Knowledge of materials, methods, and the tools involved in the construction or repair of houses, buildings, or other structures such as highways and roads.

Job Title: Quality Control Chief

SUMMARY:

Under general supervision, coordinates the collection, evaluation, and dissemination of performance data relative to specified quality improvement programs within a patient care facility or a broadly-focused health care related service or clinical research program. Maintains documents and records according to protocol requirements and governmental health care standards.

DUTIES AND RESPONSIBILITIES:

1. Collects, analyzes, and oversees data entry on relevant quality performance indicators.
2. Monitors and evaluates appropriateness of facility quality control plans and practices.
3. Designs, schedules and conducts quality review audits as appropriate to the facility or service; performs or coordinates chart and/or other medical record reviews and records and/or abstracts specific relevant data as appropriate.
4. Generates and/or coordinates the development of various reports regarding performance against quality indicators, as appropriate to the individual position.
5. Participates in the planning, development, coordination, and presentation of specific training and educational programs as appropriate to the quality assurance needs of the facility or service.
6. Collaborates and consults with other associated facilities regarding current quality control issues and activities.

MINIMUM JOB REQUIREMENTS:

Bachelor's degree; at least 3 years of experience that is directly related to the duties and responsibilities specified.

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

- Records maintenance skills.
- Knowledge of product care charts and process histories.
- Ability to write reports containing technical information.
- Knowledge of accreditation and certification requirements and standards.
- Word processing and/or data entry skills.
- Ability to develop and present educational programs and/or workshops.
- Knowledge of quality control practices and procedures within a hospital, patient care, or registry environment.
- Ability to make evaluative judgments.
- Ability to communicate effectively, both orally and in writing.

WORKING CONDITIONS AND PHYSICAL EFFORT:

- Work is normally performed in a typical interior/office work environment.
- No or very limited physical effort required.
- No or very limited exposure to physical risk.

Job Title: Inventory Stock Chief

SUMMARY:

Coordinates the acquisition, disposition, and control of equipment, supplies, and/or materials according to established policies and procedures. Coordinates the transfer of reusable/recyclable equipment and materials.

DUTIES AND RESPONSIBILITIES:

1. Handles the acquisition of property, supplies, and/or materials from other agencies, to include transporting and warehousing of materials.
2. Inspects goods and material and assesses condition for distribution and/or recycling purposes.

3. Coordinates the disposal of property, supplies, and/or material in compliance with university, state, and federal regulations.
4. Maintains records of acquisition and distribution of property, supplies, and materials.
5. May supervise and/or lead lower graded staff and/or employees.
6. Performs miscellaneous job-related duties as assigned.

MINIMUM JOB REQUIREMENTS:

Bachelor's Degree; at least 2 year of experience that is directly related to the duties and responsibilities specified.

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

- Organizing and coordinating skills.
- Records maintenance skills.
- Knowledge of warehousing methodology.
- Knowledge of material transport procedures.
- Ability to determine materials, equipment, and supplies usability.
- Ability to supervise and train assigned staff.

WORKING CONDITIONS AND PHYSICAL EFFORT:

- Work involves moderate exposure to unusual elements, such as extreme temperatures, dirt, dust, fumes, smoke, unpleasant odors, and/or loud noises.
- Moderate physical activity. Requires handling of average-weight objects up to 25 pounds or standing and/or walking for more than four (4) hours per day.
- Work environment involves minimal exposure to physical risks, such as operating dangerous equipment or working with chemicals.

Job Title: Assist. of inventory Stock

SUMMARY:

Under limited direction, recommends, implements, and controls accounting policies and procedures, and coordinates and operates accounting, taxation, data control,

accounts payable, and contract and grant functions of the factory or major division thereof. Prepares consolidated financial statements and various financial reports.

DUTIES AND RESPONSIBILITIES:

1. Oversees the overall operations of unit(s) reporting to this position.
2. Exercises broad supervision of unrestricted and restricted fiscal activity to ensure sufficient fiscal controls to safeguard institutional funds while allowing the institution to accomplish its programmatic missions.
3. Coordinates financial statements, annual financial reports, audit activities, and other information reports and requests; ensures accuracy and integrity of financial reporting.
4. Develops and manages annual budgets for the organization and performs periodic cost and productivity analyses.

MINIMUM JOB REQUIREMENTS:

High school degree, at least 3 years of experience that is directly related to the duties and responsibilities specified.

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

- Organizing and coordinating skills.
- Knowledge of federal and state financial regulations, and university financial policies and procedures.
- Ability to supervise and train employees, to include organizing, prioritizing, and scheduling work assignments.
- Knowledge of organizational structure, workflow, and operating procedures.
- Knowledge of financial/business analysis techniques.
- Knowledge of current changes and/or developments in federal, state, local accounting laws, and university policies and procedures.

WORKING CONDITIONS AND PHYSICAL EFFORT:

- Work is normally performed in a typical interior/office work environment.
- No or very limited physical effort required.

- No or very limited exposure to physical risk.

Job Title: Mechanical Department Foreman

SUMMARY:

Under general supervision, provides leadership and direction to the production services team which delivers production planning and support to all organizations and artists holding events in public events venues. Responsible for all technical services, production budget management, stage personnel, equipment inventory and asset management, transportation, hospitality, and stage support spaces, as well as safety and code compliance.

DUTIES AND RESPONSIBILITIES:

1. Develops and oversees a program of support operations including lighting, sound, staging, personnel, logistics, event planning, facility scheduling, and equipment provision.
2. Plans and manages the production budget for a full season of performing arts events in Popejoy Hall, both presented events and rental use, and major events in the university arena and/or stadium.
3. Plans, develops, and oversees the management of all technical equipment and assets including support facilities.
4. Assists in the marketing of public events facilities, production services, and other assets to clients.
5. Develops safety programs, including ongoing training and development of staff.
6. Oversees the supervision of personnel, which includes work allocation, training, and problem resolution; evaluates performance and makes recommendations for personnel actions; motivates employees to achieve peak productivity and performance.
7. Participates in development, implementation and maintenance of policies, objectives, short-and long-range planning; develops and implements projects and programs to assist in accomplishment of established goals.
8. Develops annual operating budgets and provides fiscal direction to the unit.

MINIMUM JOB REQUIREMENTS:

Bachelor's degree with 3 to 5 years experience directly related to the duties and responsibilities specified.

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

- Ability to supervise and train employees, to include organizing, prioritizing, and scheduling work assignments.
- Knowledge of theater and/or public events staging procedures, techniques and facilities.
- Skill in organizing resources and establishing priorities.
- Employee development and performance management skills.
- Knowledge of theatrical and/or event production and staging costs.
- Knowledge of facilities and asset management methods and procedures.
- Knowledge of faculty and/or staff hiring procedures.
- Knowledge of marketing strategies, processes, and available resources.

WORKING CONDITIONS AND PHYSICAL EFFORT:

- Work involves moderate exposure to unusual elements, such as extreme temperatures, dirt, dust, fumes, smoke, unpleasant odors, and/or loud noises.
- Moderate physical activity. Requires handling of average-weight objects up to 25 pounds or standing and/or walking for more than four (4) hours per day.
- Work environment involves some exposure to hazards or physical risks, which require following basic safety precautions.

Job Title: Assembly Expert

SUMMARY:

Under general supervision, coordinates advance production planning and service delivery for all events presented, produced, and/or hosted by the Public Events Management Group. Performs duties such as scheduling, cost estimation, logistics, post event billings, and procurement of temporary personnel and supplies.

DUTIES AND RESPONSIBILITIES:

1. Arranges for the fulfillment of technical riders for all presented events, including hospitality, transportation, scheduling, and necessary temporary personnel (security, stage crews, etc;) as required.
2. Coordinates preparations for event staging, load-in, rehearsals, run-of show, and load-out in conjunction with Technical Services.
3. Procures necessary equipment and supplies to support events.
4. Provides event cost estimates to appropriate staff and venue users as required; prepares post event billing information for settlements.
5. Assists with monitoring and preparing the annual production budget; maintains appropriate financial records.
6. Maintains event production schedules and calendars, coordinating information with colleagues on a routine basis.
7. Performs miscellaneous job-related duties as assigned.

MINIMUM JOB REQUIREMENTS:

Bachelor's degree with 3 to 5 years experience directly related to the duties and responsibilities specified.

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

- Ability to effectively manage time and schedules.
- Ability to recruit, train, supervise, and motivate temporary/on-call events staff.
- Knowledge of technological, personnel, and logistical requirements pertaining to performing arts events.
- Skill in organizing resources and establishing priorities.
- Knowledge of alternative sources for theatrical and related supplies and equipment.
- Knowledge of costing and pricing methodology.
- Knowledge of procurement rules and regulations.

WORKING CONDITIONS AND PHYSICAL EFFORT:

- Work is normally performed in a typical interior/office work environment.
- No or very limited physical effort required.
- No or very limited exposure to physical risk.

Job Title: PAINTER

SUMMARY:

To provide journeyman level skills to perform painting.

Responsible for preparing surface for painting, applying paints to machinery, equipment, furniture and interiors and/or buildings by spray gun or brush.

DUTIES AND RESPONSIBILITIES:

Scrape, sandpaper and size surfaces preparatory to painting. Mix, blend, match and apply paints, varnishes, shellacs, enamels and other finishes. Erect or rig scaffolds. Cover surfaces and furniture to protect from paint. Remove spattered paint after job is completed. Clean and care for brushes, spray guns and other equipment. Perform related duties as assigned.

Report need for carpentry repairs.

General supervision from Foreman or Supervisor through oral and written instructions. Work is performed in accordance with standard trade practices and is inspected for conformity to specifications.

Detailed instructions to helpers assisting in the work.

MINIMUM JOB REQUIREMENTS:

3 years experience.

Three years of skilled/journeyman level experience.

Skill with tools of the painting trade, including the use of brushes, scrapers, spray guns and sanding equipment.

WORKING CONDITIONS AND PHYSICAL EFFORT:

Working conditions are considered acceptable, but involve exposure to outside weather, standing on ladders and scaffolds. Alertness and careful attention is required to avoid injury to self and to others. Specific job requirements or physical location of positions allocated to this classification render the position security sensitive and thereby subject to the provisions.

Job Title: CNC Cutting Operator

SUMMARY:

Responsible for set-up and operation of the CNC Horizontal Machine Center or the CNC Vertical Machine Center

DUTIES AND RESPONSIBILITIES: Sets up and operates manual CNC Vertical & Horizontal Machine Center.Must have proven skill set to set up and operate Vertical 3 axis and Horizontal 4 & 5 axis machine centers.Must be able to demonstrate the ability to understand center line rotation of fixtures as applied to Horizontal Machine set up.Must be versed in Rotary or Indexing capability as the application applies to the Horizontal Machine Center.Understand Z axis and Y axis clearance and tool statements to the Horizontal Machine Center.Employee will need t understand the Vertical X,Y,Z axis centerline pick up with the Vertical Machine center.Good understanding of Edge and Centerline pick up on the Vertical Machine Center.Optimize process to achieve maximum efficiency.Save updated programs.Receive daily instructions from Production Supervisor and plan day accordingly using the Shop Floor Control System.Clock in and off operations according to sequence number start date of the work order.Check parts to ensure they meet blueprint specifications using proper gauges.Perform daily maintenance check on machines and report concerns to Production Supervisor.Use proper feed and speed for maximum efficiency.Deburr work in process.Train new hires or apprentices.Follows all safety policies and procedures.Meets agreed upon goals and objectives in a timely manner.Arrives to work, meetings, appointments, and other work-related functions on time and as scheduled.

MINIMUM JOB REQUIREMENTS:

High School Diploma or GED. Preferably a Journeyman's card/Four year apprenticeship program.Must own tools supply for daily tasks (i.e. micrometers, indicators, edge finders, etc.)

Four years' experience either in a production or job shop environment.Must be able to grind cutting tools, read and interpret blueprints and work order instructions.Must be able to understand three and four axis machining.Must be able to understand the picking up of a center line of a horizontal table.Must have a working knowledge of computers.Must be able to take verbal and written instructions and work from handmade sketches.Demonsrated knowledge of G-Code programming and Horizontal machine practices.Demonstrated effective verbal, written, and communication skills.

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

Interact with organizational team members and other departments in a professional manner.

Assists in formulating departmental strategic plan.Serves as a member of various employee and organizational committees.Performs other duties as assigned.

WORKING CONDITIONS AND PHYSICAL EFFORT:

Manufacturing environment; may be exposed to loud noises, changing temperatures, machinery with moving parts, and exotic materials.Files, red handle deburr tools, table saw, band saw, pedestal grinder, pallet jack, two and four wheel carts and computer.Lifting up to 50lbs regularly and 75lbs occasionally, pushing, pulling, standing for long periods of time, manual dexterity, visual acuity, and typing.

APPENDIX 4. Sample Application Form (Interview Plan) of Work Analysis Study for Project Chief

İŞ ANALİZİ FORMU

İşletmenin adı : Çiltuğ A.Ş.

Bölüm : Proje Şefliği

Yer : Fabrika

İşin adı : Proje Şefi

Kişinin adı : Tunç Uğur

Kişi sayısı : 1

Analizi yapan kişi : Burçin ÖNAY

1) Görev Hakkında Bilgiler

İşin özeti : yapılan iş iki veya üç cümle ile özetlenir.(İşin amacı ve nasıl yapıldığı belirtilir.)

–proje ihtiyaç malzeme listesinin hazırlanması, kesim ve imalat resimlerinin hazırlanması,keisn planlarının hazırlanıp kontrol edilmesi.

Temel Görevler

% 1)Yıllık genel iş-termin programlarının hazırlanması

% 2) Proje iş programlarının hazırlanması

Periyodik Görevler

% 1)Sıvı-Penetron testlerinin ve ultrasonik test muayenelerinin yapılması ve raporlanması

% 2) Gerektiğinde projenin oluşturulması,teknik resimlerin oluşturulması(Tasarım)

2) İş için Gerekli Olan Asgari Özellikler

Eğitim Düzeyi : Eğitim süreci,işi yapabilmek için gerekli olan yeteneğe sahip olabilmek için öngörülür(yabancı dil,mantıksal ve matematiksel işlemler,analitik düşünme gibi)

-Üniversite mezunu (lisans),mantıksal işlemler,matematiksel iş,analitik düşünme,takım çalışmasına yatkınlık

Özel Yetenekler

- Hassas çalışabilme x
- Hızlı kavrayabilme x
- Ani karar verebilme x
- Vücut yeteneği x(yan işlerde)

Mesleki Hazırlık: Mesleki eğitim,çıraklık eğitimi,tecrübe ve işletme içinde veya dah önce aldığı eğitimleri içeren bir süreçtir.(Daha önce çalıştığı dalda çaşlışıyor olmak)

-Manyetik test level 1 ,(Tahribatsız muayeneler testleri)

Ultrasonik test level 2,(CNC promotion test program operatörlüğü)

Sıvı penetration test level 2

Sorumluluklar : Örneğinürün ve ekipman sorumluluğu,finansal sorumluluk gibi…

-Ofis malzemeleri,ultrasonik test cihazı

Yabancı diller : İş için gerekli olan yabancı dil seviyesi belirtilir.

-İngilizce,almanca

3) Organizasyonel İlişkiler

Yönetim : Yönetim yetkisi ve denetimi altında bulunan işlerle belirtilir.

-Fabrika müdürü.

Diğer görevlerle olan ilişkileri : Belirtilen işin diğer işlerle olan bağlantılarını belirtir.

-İmalat Şefliği,ambar-stok,kalite kontrol müdürlüğü

Mental çaba : Mental yetenekler karmaşık verilere sahip,farklı fikr ve durumlardaki algılama kapasitesidir.

Koordinasyon x * İşbirliği x * Dikkat x Beyin Fırtınası

Hafıza x Gözlem x * Kontrol x

3) İş için gerekli olan çabalar

Fiziksel çaba : Fiziksel çaba,fiziksel çalışma ve ayakta veya oturarak çalışma pozisyonlarının süre tiplerini gösterir.Oturmadan ayağa kalkmaya,harekete geçmeye veya diğer çalışma pozisyonlarının geçiş sürelerinin yüzdeleri belirtilir.

Ayakta durma % Oturma %40 Hareket Hali %50 Diğer %10

(Kontrolde)

Vücut Çabası

Taşıma Ağırlığı - Yürüme x Görme yetisi x

El hareketleri x Kol hareketleri x Renk ayrımı x

Bacak ve Vücut Hareketleri - Çömelme x Dönme x

Çalışma Koşulları : Çalışma ortamının koşulları,sıcaklık,nem,gürültü gibi.

Isı - Hava akımı x(şantiyeler)

Soğukluk	x	Aydınlatma	yeterli
Toz	x	Gürültü	x
Duman	x	Gaz	-
Yakıcı ve yanıcı malzemeler	x	Mesleki düzensizlikler	-
Radyasyon	-	Baskı	-

İş tehlikesi : İş kazaları gibi durumlar

Yanma	-	Kesme	x	Çarpma	x	Elektrik şoku	x
Düşme	x	Zehirlenme	-	Ağırlık altında kalma	x		
Vücutta kalıcı hasar oluşumu	x						

APPENDIX 5. Calculation tables of works according to factor points.

Factory Administrator							
FACTORS	**PERCENT**	**POINT**	**FACTOR DEGREE POINTS**				
			1	**2**	**3**	**4**	**5**
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Control	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Project Chief FACTORS	PERCENT	POINT	FACTOR DEGREE POINTS				
			1	2	3	4	5
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Control	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Production Chief FACTORS	PERCENT	POINT	FACTOR DEGREE POINTS				
			1	2	3	4	5
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Control	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Qulity Control Chief							
FACTORS	**PERCENT**	**POINT**	**FACTOR DEGREE POINTS**				
			1	**2**	**3**	**4**	**5**
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Control	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Inventory/Stock Chief							
FACTORS	**PERCENT**	**POINT**	**FACTOR DEGREE POINTS**				
			1	**2**	**3**	**4**	**5**
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Control	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Assist of Inventory Stock							
FACTORS	**PERCENT**	**POINT**	**FACTOR DEGREE POINTS**				
			1	**2**	**3**	**4**	**5**
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Control	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Technical Drawer FACTORS	PERCENT	POINT	FACTOR DEGREE POINTS				
			1	2	3	4	5
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Control	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Computer Operator							
FACTORS	**PERCENT**	**POINT**	**FACTOR DEGREE POINTS**				
			1	**2**	**3**	**4**	**5**
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Control	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Mechanical Department Foreman							
FACTORS	**PERCENT**	**POINT**	**FACTOR DEGREE POINTS**				
			1	**2**	**3**	**4**	**5**
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Control	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Mechanical Maintanence&Const.C FACTORS	PERCENT	POINT	FACTOR DEGREE POINTS				
			1	2	3	4	5
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Control	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Electrical Maint.&Construction C. FACTORS	PERCENT	POINT	FACTOR DEGREE POINTS				
			1	2	3	4	5
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Conrol	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Assembly Expert FACTORS	PERCENT	POINT	FACTOR DEGREE POINTS				
			1	2	3	4	5
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Conrol	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Twisting Operator							
FACTORS	**PERCENT**	**POINT**	**FACTOR DEGREE POINTS**				
			1	**2**	**3**	**4**	**5**
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Conrol	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Turning Operator							
FACTORS	**PERCENT**	**POINT**	**FACTOR DEGREE POINTS**				
			1	**2**	**3**	**4**	**5**
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Conrol	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

CNC Cutting Operator							
FACTORS	**PERCENT**	**POINT**	**FACTOR DEGREE POINTS**				
			1	**2**	**3**	**4**	**5**
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Conrol	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Milling Operator FACTORS	PERCENT	POINT	FACTOR DEGREE POINTS				
			1	2	3	4	5
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Conrol	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Sandblasting & Dyeing							
FACTORS	**PERCENT**	**POINT**	**FACTOR DEGREE POINTS**				
			1	**2**	**3**	**4**	**5**
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Conrol	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Painter FACTORS	PERCENT	POINT	FACTOR DEGREE POINTS				
			1	2	3	4	5
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Conrol	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Welder			FACTOR DEGREE POINTS				
FACTORS	**PERCENT**	**POINT**	**1**	**2**	**3**	**4**	**5**
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Conrol	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50	1.00	2.00	5.00	9.00

Cleaner	PERCENT	POINT	FACTOR DEGREE POINTS				
FACTORS			**1**	**2**	**3**	**4**	**5**
1- SKILL	0.503	**503**					
Education	0.495	249	17.00	31.00	63.00	127.00	249.00
Experience	0.194	98	7.00	12.00	25.00	50.00	98.00
Private Ability	0.185	93	6.00	11.00	23.00	47.00	93.00
Communication	0.086	43	3.00	5.00	11.00	22.00	43.00
Basic Knowledge	0.040	20	1.00	3.00	5.00	10.00	20.00
2- RESPONSIBILITY	0.134	**134**					
Human	0.634	85	6.00	10.00	21.00	43.00	85.00
Documentaion	0.260	35	2.00	4.00	9.00	18.00	35.00
Machine	0.106	14	1.00	2.00	4.00	7.00	14.00
3- MENTAL EFFORT	0.260	**260**					
Coordination	0.503	131	9.00	16.00	33.00	67.00	131.00
Attention	0.260	68	5.00	8.00	17.00	35.00	68.00
Memory	0.134	35	2.00	4.00	9.00	18.00	35.00
Observation	0.068	18	1.00	2.00	5.00	9.00	18.00
Conrol	0.035	9	0.60	1.00	2.00	5.00	9.00
4- BODY EFFORT	0.068	**68**					
Standing	0.633	43	3.00	5.00	11.00	22.00	43.00
Moving	0.260	18	1.00	2.00	5.00	9.00	18.00
Sedentary	0.107	7	0.40	1.00	2.00	4.00	7.00
5-ENVIRONMENTAL CONDITIONS	0.035	**35**					
Working Conditions	0.750	26	2.00	3.00	7.00	13.00	26.00
Working Risks	0.250	9	0.50				

APPENDIX 6. 5S Team lists.

Table A.1 5S List of Factory-1

BAŞPINAR FABRİKA ÇİLTUĞ TARAFI PERSONEL LİSTESİ						
BİRİM	**TAKIM**	**SIRA NO**	**AD-SOYAD**	**EKİP SAYISI**	**GÖREV**	**SPONSOR**
İDARİ KADRO		1	LEVENT AYDIN	6	FABRİKA MÜDÜRÜ	LEVENT AYDIN
		2	FAİK ÖZER UÇAR		İMALAT ŞEFİ	
		3	ARİF CAN TEKE		İMALAT ŞEFİ	
		4	MUHİTTİN MİŞE		İMALAT ŞEFİ	
		5	TAHİR YILAN		FORMEN/GRUP LİDERİ	
		6	MURAT CİN		TALAŞLI İMALAT FORMENİ	
GERİ HİZMET		7	ŞAHİN SOLAK	6	TLA / TL	MEHMET HÜSNÜ KOZAN
		8	ALİ EKBER SOLAK		BEKÇİ	
		9	MECİT ALBAYRAM		BEKÇİ	
		10	MUSTAFA DOĞAN		YEMEKHANE (ENGELLİ)	
		11	ULAŞ AKÇİL		MEYDANCI (ENGELLİ)	
		12	MUHARREM KARAOĞLAN		MEYDANCI (ENGELLİ)	
KESİM BÜKÜM BOYA	**TAKIM 1**	13	AHMET KARAGÜLLEOĞLU	7	TLA / TL	MUHİTTİN MİŞE
		14	TALAT UZ		PLAZMA OPERATÖRÜ	
		15	AHMET MAT		PLAZMA OPERATÖR YRD.	
		16	MEHMET ALİ ÇOLAK		KAYNAKÇI	

		17	TAYFUN UZ		YARDIMCI OPERATÖR	
		18	MEHMET TAN		BOYACI	
		19	KADİR DEMİR		BOYACI	
İMALAT	TAKIM 2	20	BARIŞ KAHRAMAN	8	TLA / TL	ARİF CAN TEKE
		21	MUHİTTİN PEKTAŞ		MONTAJ YARDIMCISI	
		22	CAFER TAŞDELEN		KAYNAKÇI	
		23	ŞIHLI DOĞAN		KAYNAKÇI	
		24	MURAT GAMSIZ		KAYNAKÇI	
		25	ÖKKEŞ DEMİR		YARDIMCI	
		26	SAİT KAYA		YARDIMCI	
		27	MUSA KAHRAMAN		YARDIMCI	
	TAKIM 3	28	MEHMET BACAKSIZ	11	TLA / TL	FAİK ÖZER UÇAR & ABDULMUTTALİP KAYA
		29	MEHMET ÖZCANLI		MONTAJ YARDIMCISI	
		30	NİZAMETTİN ASLAN		KAYNAKÇI	
		31	MÜSLÜM EYİBİLEN		KAYNAKÇI	
		32	UĞUR KARABULUT		KAYNAKÇI	
		33	NİHAT YILAN		KAYNAKÇI	
		34	NURİ KUŞ		KAYNAKÇI	
		35	SAİT DOĞAN		YARDIMCI	
		36	ABDULBAKİ EMLİK		YARDIMCI	
		37	ABDULLAH SUNGUR		YARDIMCI	
		38	HASAN KARA		YARDIMCI	
	TAKIM 4	39	HÜSEYİN KILIÇ	7	TLA / TL	FAİK ÖZER UÇAR
		40	MUSTAFA KESMEZOĞLU		MONTAJ YARDIMCISI	
		41	HALİL TOPLAR		MONTAJ YARDIMCISI	
		42	MEHMET TİBİK		KAYNAKÇI	

		43	İBRAHİM HALİL KARAHAN		KAYNAKÇI	
		44	ERCAN KAYAN		YARDIMCI	
		45	MEHMET KAYA(Ahmet oğlu)		YARDIMCI	
	TAKIM 5	46	HASAN PEKTAŞ	11	TLA / TL	FAİK ÖZER UÇAR & ABDULMUTTALİP KAYA
		47	ALİ İNKO		MONTAJ YARDIMCISI	
		48	MEHMET ERCAN		KAYNAKÇI	
		49	İSMAİL ÜZEN		KAYNAKÇI	
		50	MEHMET ÖZAVCİ		KAYNAKÇI	
		51	FERHAT DOĞUŞ DEMİR		YARDIMCI	
		52	AHMET UÇAN		YARDIMCI	
		53	MEHMET KANDEMİR		YARDIMCI	
		54	BÜLENT ALTUN		YARDIMCI	
		55	ADEM ÇOLAK		YARDIMCI	
		56	MÜSLÜM ZEYREK		YARDIMCI	
	TAKIM 6	57	ADEM YILMAZ	9	TLA / TL	ARİF CAN TEKE
		58	MEHMET DEMEZ		KAYNAKÇI	
		59	HASAN HASTOPRAK		KAYNAKÇI	
		60	CEVDET ERGİN		KAYNAKÇI	
		61	HASAN YOLDAŞ		KAYNAKÇI	
		62	EROL ŞAHİN		YARDIMCI	
		63	HANİFİ YALÇIN		YARDIMCI	
		64	HACI KARAPUNAR		YARDIMCI	
		65	ÖMER KILIÇ		YARDIMCI	
	TAKIM 7	66	SELAHATTİN YİĞİT	7	TLA / TL	ARİF CAN TEKE
		67	ÖMER BEKAR		KAYNAKÇI	
		68	MEHMET ASLAN		YARDIMCI	
		69	MUSTAFA ERDOĞAN		YARDIMCI	
		70	SALİH ALP		YARDIMCI	
		71	GÖKHAN ŞAHİN		YARDIMCI	
		72	MEHMET ALDAN		YARDIMCI	

	TAKIM 8	73	YUSUF GEZER	10	TLA / TL	ARİF CAN TEKE
		74	HACI YUSUF ERDOĞAN		YARDIMCI	
		75	NAHSEN ÇELİK		KAYNAKÇI	
		76	FERHAT KAYMAK		KAYNAKÇI	
		77	İSMET DURGUT		KAYNAKÇI	
		78	FAZLI ÇEVİK		KAYNAKÇI	
		79	İHSAN ÜSTÜN		YARDIMCI	
		80	ABDULLAH EKİNCİ		YARDIMCI	
		81	MUHAMMET ALİ ÇELİK		YARDIMCI	
		82	İBRAHİM HALİL DURGUT		KAYNAKÇI	
KALİTE	**TAKIM 9**	83	HALİL İBRAHİM BARAZİ	4	UT - MT - PT - VT	UĞUR ÇALIŞIR
		84	ADİL BALCI		UT - MT - VT	
		85	YUNUS ALTINTAŞ		KALİTE İNSPEKTÖRÜ	
		86	ADEM ALMAS		MT - PT - VT	
TALAŞLI İMALAT	**TAKIM 10**	87	TUNCAY SOLAK	14	TLA / TL	MEHMET BURÇİN ÖNAY
		88	KEMAL SOLAK		OPERATÖR	
		89	ABDULMECİT YILDIRIM		OPERATÖR	
		90	ABDULLAH ÇALIŞICI		OPERATÖR	
		91	MUSTAFA DERTLİ		OPERATÖR	
		92	MUSTAFA DURAK		OPERATÖR	
		93	NECMİ KAYA		YARDIMCI OPERATÖR	
		94	EKREM AKASLAN		OPERATÖR	
		95	MUTLU GÖK		OPERATÖR	
		96	EKREM KURT		OPERATÖR	
		97	HIŞMAN GEREZ		OPERATÖR	
		98	İBRAHİM ÖZTÜRK (Bozan oğlu)		OPERATÖR	
		99	EYUP KORKMAZ		OPERATÖR	
		100	SEYFETTİN YEDİPINAR		YARDIMCI OPERATÖR	

TAŞERON	101	HALİT SAÇLI	4	KAYNAKÇI	YUSUF DAŞ
	102	CUMALİ COŞKUN		KAYNAKÇI	
	103	SERKAN BAYHAN		KAYNAKÇI	
	104	HAKAN TÜRE		KAYNAKÇI	
ŞANTİYE	105	İBRAHİM KILIN	3	VİNÇ OPERATÖRÜ	**OUT OF SCOPE**
	106	ALİ OKAN YILMAZ		VİNÇ OPERATÖRÜ	
	107	MEHMET PALA		FORMEN/GRUP LİDERİ	

Table A.2 5S List of Factory-2

BAŞPINAR FABRİKA SUDE TARAFI PERSONEL LİSTESİ						
BİRİM	**TAKIM NO**	**SIRA NO**	**AD-SOYAD**	**EKİP SAYISI**	**GÖREV**	**SPONSOR**
İDARİ KADRO		1	ZEKİ UĞUR	6	GENEL MÜDÜR	ZEKİ UĞUR
		2	ERHAN YAMAKALİOĞLU		FABRİKA MÜDÜRÜ	
		3	MUSA EREN DOĞANGÜL		İMALAT ŞEFİ	
		4	İBRAHİM ASLAN		FORMEN	
		5	MEHMET SAİT FIRAT		FORMEN	
		6	EMİN BÖYÜKOCAKOĞLU		TALAŞLI İMALAT FORMENİ	
GERİ HİZMET		7	ABDURRAHMAN ATEŞ	11	TLA / TL	MEHMET HÜSNÜ KOZAN
		8	MUZAFFER TURAN		FORKLİFT OPERATÖRÜ	
		9	MEMET ÖZDEMİR		BEKÇİ	
		10	MAHMUT UĞUR		BEKÇİ	
		11	VAKKAS DOĞAN(ENGELLİ)		ÇAY OCAĞI	
		12	AYHAN ARSLAN		MEYDANCI	
		13	ABDULLAH POLAT		MEYDANCI	
		14	BÜLENT KAPLAN		YEMEKHANE	

		15	YAHYA YÜCEL		YEMEKHANE	
		16	NİHAT HOŞGÖREN		YARDIMCI	
		17	MEHMET YILDIZHAN		PORTAL VİNÇ OPERATÖRÜ	
KESİM BÜKÜM BOYA	**TAKIM 1**	18	EYUP ASLAN	4	TLA / TL	MUSA EREN DOĞANGÜL
		19	ÖKKEŞ ŞEN ERDEMCİ		PLAZMA OPERATÖRÜ	
		20	ORHAN KAYA		SİLİNDİR OPERATÖRÜ	
		21	MEHMET KAHRAMAN		SİLİNDİR OPERATÖR YRD.	
İMALAT	**TAKIM 2**	22	ALİ YILDIRIM	9	TLA / TL	MUSA EREN DOĞANGÜL
		23	ÖZGÜR MUSTAFA AĞBAYIR		MONTAJ YARDIMCISI	
		24	MEHMET DOĞAN		MONTAJ YARDIMCISI	
		25	TALİP BULDUM		KAYNAKÇI	
		26	VAKKAS KARTAL		KAYNAKÇI	
		27	SERVET ÇELBİŞ		YARDIMCI	
		28	FETTAH YILDIRIM		KAYNAKÇI	
		29	NEDİM KAYA		KAYNAKÇI	
		30	ABDULLAH ERGÜN		YARDIMCI	
	TAKIM 3	31	HACI ALİ KILINÇ	13	TLA / TL	ERHAN YAMAKALİOĞLU
		32	MUHARREM ŞIHTUĞ		MONTAJ YARDIMCISI	
		33	MEHMET TEKİN		MONTAJ YARDIMCISI	
		34	DENİZ ATMACA		KAYNAKÇI	
		35	KADİR ASLAN		KAYNAKÇI	
		36	MAHMUT KARABULUT		KAYNAKÇI	
		37	BARIŞ YAĞIŞAK		YARDIMCI	
		38	OSMAN OGUZ		YARDIMCI	
		39	MEHMET ERASLAN		KAYNAKÇI	
		40	HİCRİ YILDIZ		YARDIMCI	
		41	SELİM ÇİĞİT		YARDIMCI	
		42	ERMAN DURAN		YARDIMCI	
		43	MEHMET VELİCAN TUZCU		YARDIMCI	

	TAKIM 4	44	MÜSLÜM KARAKURT	12	TLA / TL	MUSA EREN DOĞANGÜL
		45	MURAT PARLAKYILDIZ		YARDIMCI	
		46	LÜTFÜ ZORBA		MONTAJCI	
		47	İLYAS DOĞAN		MONTAJ YARDIMCISI	
		48	YAŞAR PIÇAKLAR		KAYNAKÇI	
		49	AHMET BAYRAM		KAYNAKÇI	
		50	SERVET TÜRKAN		MONTAJ YARDIMCISI	
		51	MÜSLÜM ASLAN		YARDIMCI	
		52	GÖKHAN DOĞAN		YARDIMCI	
		53	İBRAHİM HALİL HALHALLI		KAYNAKÇI	
		54	MEHMET KAYA		YARDIMCI	
		55	HAMİT DEMİR		YARDIMCI	
	TAKIM 5	56	HÜSEYİN KILIÇ	9	TLA / TL	ERHAN YAMAKALİOĞLU
		57	MEHMET OKTAY		MONTAJ YARDIMCISI	
		58	MAHMUT YILDIRIM		MONTAJCI	
		59	YILMAZ BEKKİ		MONTAJCI	
		60	AHMET ŞAHİN		YARDIMCI	
		61	OSMAN KARAOĞLAN		YARDIMCI	
		62	İBRAHİM ÖZTÜRK		MONTAJ YARDIMCISI	
		63	VELİ ÇATALBAŞ		KAYNAKÇI	
		64	AHMET ASLAN		KAYNAKÇI	
	TAKIM 6	65	MECİT YILDIRIM	10	TLA / TL	ERHAN YAMAKALİOĞLU
		66	ALİ YETİŞGİN		YARDIMCI	
		67	MÜSLÜM DOĞAN		KAYNAKÇI	
		68	MEHMET ALAGÖZ		KAYNAKÇI	
		69	HÜSEYİN TOPLAR		KAYNAKÇI	
		70	İBRAHİM KÖSE		YARDIMCI	
		71	MEHMET TOPLAR		YARDIMCI	
		72	İSMAİL TAMER		YARDIMCI	
		73	ALİ DURMUŞ		YARDIMCI	
		74	İBRAHİM DENİZ		YARDIMCI	

	TAKIM 7	75	MİKAİL İYİBİLEN	11	TLA / TL	ERHAN YAMAKALİOĞLU
		76	ERGÜN DURMUŞ		KAYNAKÇI	
		77	HÜSEYİN SUCU		KAYNAKÇI	
		78	REMZİ BOZYİĞİT		KAYNAKÇI	
		79	DAVUT KISACIK		KAYNAKÇI	
		80	MÜSLÜM ÇELİK		YARDIMCI	
		81	MÜSLÜM AĞCABAY		KAYNAKÇI	
		82	MEMİK SOLMAZ		YARDIMCI	
		83	REGAİP ŞAHİN		YARDIMCI	
		84	RECEP KOYUNCU		YARDIMCI	
		85	TAYFUN ŞAHİN		YARDIMCI	
TALAŞLI İMALAT	**TAKIM 8**	86	MURAT BIRAK	8	TLA / TL	MUSA EREN DOĞANGÜL
		87	EYÜP YILDIZ		OPERATÖR YRD.	
		88	AHMET ERASLAN		KAYNAKÇI	
		89	ABBAS DOGAN		YARDIMCI	
		90	ERCAN OTTAŞ		OPERATÖR	
		91	CEM TAŞDOĞAN		OPERATÖR	
		92	ERKAN DURAN		OPERATÖR YRD.	
		93	SAİT ATEŞ		OPERATÖR YRD.	
TAŞERON		94	M.CAN ÖZDEMİR	4	BOYACI	MUSA EREN DOĞANGÜL
		95	ALİ KAYA		BOYACI	
		96	MEHMET DURGUT		BOYACI	
		97	MUHAMMED SALİM TANRIVERDİ		BOYACI	
ŞANTİYE		98	MEHMET KAPLAN	3		**OUT OF SCOPE**
		99	NEVZAT ACAR			
		100	KEMAL İNAÇ			

Table A.3. 5S List of common personnels for Factory-1 & Factory-2.

BAŞPINAR FABRİKA ÇİLTUĞ VE SUDE TARAFI ORTAK PERSONEL LİSTESİ					
BİRİM	**TAKIM**	**SIRA NO**	**AD-SOYAD**	**EKİP SAYISI**	**GÖREV**
KALİTE KONTROL		**1**	**UĞUR ÇALIŞIR**	**4**	**KALİTE KONTROL MÜDÜRÜ**
		2	**RECEP GÜNDÜZ**		**KALİTE MÜHENDİSİ**
		3	**MUSTAFA HİNTOĞLU**		**KALİTE MÜHENDİSİ**

		4	ENES GÜN		KALİTE MÜHENDİSİ
İDARİ İŞLER		5	MEHMET BURÇİN ÖNAY	9	İDARİ İŞLER MÜDÜRÜ
		6	MEHMET HÜSNÜ KOZAN		MUHASEBE ŞEFİ
		7	MEHMET BAŞAR		PERSONEL ŞEFİ
		8	A. TURGUT TEKKANAT		AMBAR STOK ŞEFİ
		9	ABDULMUTTALİP KAYA		İŞ HAZIRLAMA MÜHENDİSİ
		10	OSMAN YAĞCI		GENEL FORMEN
		11	YUSUF DAŞ		KAYNAK FORMENİ
		12	VEYSEL KILINÇ		YALIN ÜRETİM AMİRİ
		13	M. ATAMAN GÜRSEL		İSG UZMANI
BAKIM ONARIM		14	CEMAL SONGUR	5	ELEKTRİKÇİ
		15	İLHAN KIZILCIK		BAKIMCI
		16	BURHAN ERDOĞAN		ELEKTRİKÇİ
		17	YUNUS EMRE DOĞAN		ELEKTRİKÇİ
		18	METİN ÖZTÜRK		BAKIMCI
ŞOFÖR		19	ARİF TÜM	4	ŞOFÖR
		20	HÜSEYİN TÜM		ŞOFÖR
		21	SABRİ AKSU		ŞOFÖR
		22	SEYDİ BATTAL DOĞAN		ŞOFÖR