POLITECNICO DI TORINO

MASTER OF SCIENCE IN ENGINEERING AND MANAGEMENT

Impact of Total Quality Management Practices on Corporate Sustainable Development with Emphasis on Green Innovation in Manufacturing Companies (Case Study: PARS KHAZAR Industrial Company)

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July 2021

Abstract

The main purpose of this study, which was conducted in PARS KHAZAR Industrial Company as one of the most important and experienced manufacturers of home appliances in Iran, is to investigate and evaluate the effects of Total Quality Management measures on Sustainable Development of the company according to the mediating role of Green Innovation variable.

The researcher in this dissertation according to the thematic background of the research and also the experiences he had gained during his internship in the same degree and in the same company, as well as through field studies and interviews with managers and experts of the company dimensions such as leadership, Knowledge and process management, customer focus, strategic planning, supplier quality management and human resource management were considered as the main parts of TQM.

Also, in relation to the development of company sustainability, environmental, social and economic sustainability was on the agenda of the researcher. In addition, in the variable section of green innovation, the two concepts of Green Technology Innovation and Green Management Innovation were mentioned.

According to the conceptual model formed from the above variables, which is in fact considered as the theoretical support of this research, the author uses the questionnaire tool to provide the required data on how the relationship between the research model variables of company managers at three levels, Collected intermediate and operational and then in two sections of descriptive and analytical statistics, conducted field research in PARS KHAZAR Industrial Company, which as a result with the help of structural equation modeling technique and using Smart PLS software, all The hypotheses presented in this study were confirmed.

Then, according to the results and findings of the research, effective practical suggestions for improving Total Quality Management in order to achieve the company's goals to achieve Sustainable Development were presented with regard to the mediating role of Green Innovation. Doing this research, ideas were suggested for future researchers to research the company's priority and vital issues.

Acknowledgements

First of all, I would like to express my deep and sincere gratitude to my research supervisor, Prof. Domenico Augusto Francesco Maisano, for giving me the opportunity to do research and providing invaluable guidance throughout this dissertation.

I am also grateful to the company's Managers and Operators in which I carried out this investigation, for allowing me to study their processes in detail.

This work wouldn't be possible without the unmeasurable support received from my family. Special thanks to my father, for inspiring me and teaching me the most important values in life. I am extremely grateful to my parents for their love, prayers, caring and sacrifices for educating and preparing me for my future.

Summery

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Chapter 1: Introduction to Research

1-1 Introduction

This chapter briefly discusses the scope of dissertation, acronyms, and problem statement in the industry under study, the importance and necessity of research, research objectives, research innovation and research domain.

1-2 Thesis Scope

In recent years, the concepts of total quality management, green innovation and sustainable development of companies have received much attention because each of them will lead to the survival of companies by creating a competitive advantage. While TQM seeks sustainable development in corporate performance, green innovation also improves flexibility and adaptability to environmental change. In an age where the intellectual structure is full of deepening quality and pay attention to creative and knowledgeable manpower instead of functional manpower, total quality management has emerged as the most important factor of competition and along with it, green innovation considered as a strategic factor for the growth and survival of companies and consequently sustainable development in today's competitive world. As a result, the border between developed countries (developed and industrial) and developing countries is in better use and utilization of TQM knowledge and green innovation in line with the goals of sustainable development of companies.

1-3 Acronyms

The abbreviations of this dissertation are as follows:

Total Quality Management (TQM)

Sustainable Development (SD)

Green Innovation (GI)

Green Technological Innovation (GTI)

Green Management Innovation (GMI)

1-4 Problem Statement in the Study Industry (Pars Khazar Industrial Company)

Attention to the issue of environmental and social impacts of organizational activities of total quality management is growing at the international level.

An important way through which industrial companies such as PARS KHAZAR try to implement total quality management properly is to report the sustainability of companies' performance. The term corporate performance sustainability is derived from the broader concept of sustainable development.

Therefore, in order to meet the needs of customers and achieve the goals of sustainable development (SD), industrial companies such as PARS KHAZAR have adopted several strategies that have been proven to increase organizational performance, such as total quality management (TQM) which from They use it as a tool that allows them to increase customer satisfaction by improving quality. Over the past two decades, TQM has received a great deal of attention in the world of industry and commerce and has been recognized as an essential element in designing strategies, developing the quality of new products and services, and managing operational processes. Today, total quality management has become an important issue globally, and the scientific and business communities both believe that organizations with quality power can maintain their long-term and sustainable superiority in competitive areas.

On the other hand, sustainable development has three phases of environmental, social and economic sustainability. Environmental sustainability emphasizes the environment and natural resources, social sustainability is related to society and people, and economic sustainability focuses on economic and financial aspects (Guerrero et al., 2018). Green innovation is also a concept that aims to facilitate the performance of companies to produce environmentally friendly products so that the goals of sustainable development are achieved (Zhi et al., 2019). Green innovation is divided into two categories: green technological innovation (GTI) and green management innovation (GMI). GTI aims to integrate

environmental knowledge with technology. Through the GTI, companies produce a new process or product or improve an existing product by saving raw materials, energy and resources, which leads to coordination between the production process and economic and environmental activities (Fernando Et al., 2019). In GMI, companies create or remodel new management systems in their structure so that they can improve management and production processes or reduce negative environmental impacts (Chi et al., 2010). This problem and the basic question to answer whether the methods (dimensions) of total quality management (TQM) affect the sustainable development of PARS KHAZAR Industrial Company with an emphasis on green innovation? And if there is an impact, what will the process be like?

1-5 Importance and Necessity of Research

Accurate implementation of total quality management not only enables PARS KHAZAR Company to gain a competitive advantage, but also is a useful tool to improve its performance. Innovation also includes the successful implementation of creative ideas in the Caspian Sea including PARS KHAZAR Industrial Company. In PARS KHAZAR Company, green innovation is a concept that aims to facilitate the company's performance to produce environmentally friendly products so that the goals of sustainable development are achieved.

1-6 Research Objectives

In this study, the researcher seeks to investigate and assess the impact of total quality management (TQM) methods (dimensions) on the sustainable development of PARS KHAZAR Industrial Company with emphasis on green innovation.

1-6-1 Applied Objectives of Research

Assessing all the hypotheses in the conceptual model of research through related tests and summarizing the results and findings of the research in order to formulate political recommendations for PARS KHAZAR Company in order to achieve its sustainable development.

1-7 Research Innovation

Given the limited research background on the present idea, especially in PARS KHAZAR Industrial Company, the implementation of this study idea with emphasis on measuring the

impact of total quality management (TQM) methods (dimensions) on sustainable development of companies with a mediating role of green innovation for the first time in this operational company. It is a new and innovative aspect of this dissertation.

1-8 Research Domain

1-8-1 Research Subjective Domain

TQM and its impact on sustainable development with emphasis on the mediating role of green innovation.

1-8-2 Research Place Domain

The research area is PARS KHAZAR Industrial Company in Rasht, located in northern of Iran.

1-8-3 Research Time Domain

The time domain of the present research is in terms of the time nature of the required data and the time of conducting the research operation in the academic year 2020-2021.

1-9 Chapter Summary

In this chapter, the scope of dissertation, acronyms, and problem statement in the studied industry, importance and necessity of research, research objectives, research innovation and finally the domain of research were introduced.

Chapter 2: Introduction of PARS KHAZAR Industrial Company

2-1 Introduction

In this chapter, while providing an overview of PARS KHAZAR Industrial Company, the researcher introduces the structure of the company and its various production sectors and explains the policies of total quality management and other related issues.

2-2 Company Overview

PARS KHAZAR INDUSTRY COMPANY is an Iranian small appliance manufacturer based in Tehran, Iran. In March 1969, Pars Toshiba Company started its activities in Guilan Province with partnership and technical cooperation of Toshiba Manufacturer in Japan. In November 1982, the name of Pars Toshiba Company changed to the PARS KHAZAR Industrial Company. Currently, PARS KHAZAR Industrial Company as the largest manufacturer of small electrical home appliances in Iran, has continued its activities in public stock form and its shares are floated on the Stock Exchange Organization as well. The company is also one of the main pillars of PARS TOUSHEH Investment Company. Customer satisfaction, design and development of new products and making endeavors in direction to prosperity of the Iran are on the company's agenda. PARS KHAZAR Industrial Company produces 38 product groups in 209 high quality models and sends them to domestic and foreign markets. PARS KHAZAR Products Group includes all kinds of fans, convector heaters, fan heaters, rice cookers, Meat Grinder, Sandwich maker, barbecue cooker, rice cooker and electric kettle. The honors and successes of PARS KHAZAR Industrial Company in the form of statues, certificates, and certificates of appreciation are among the most important managerial achievements.

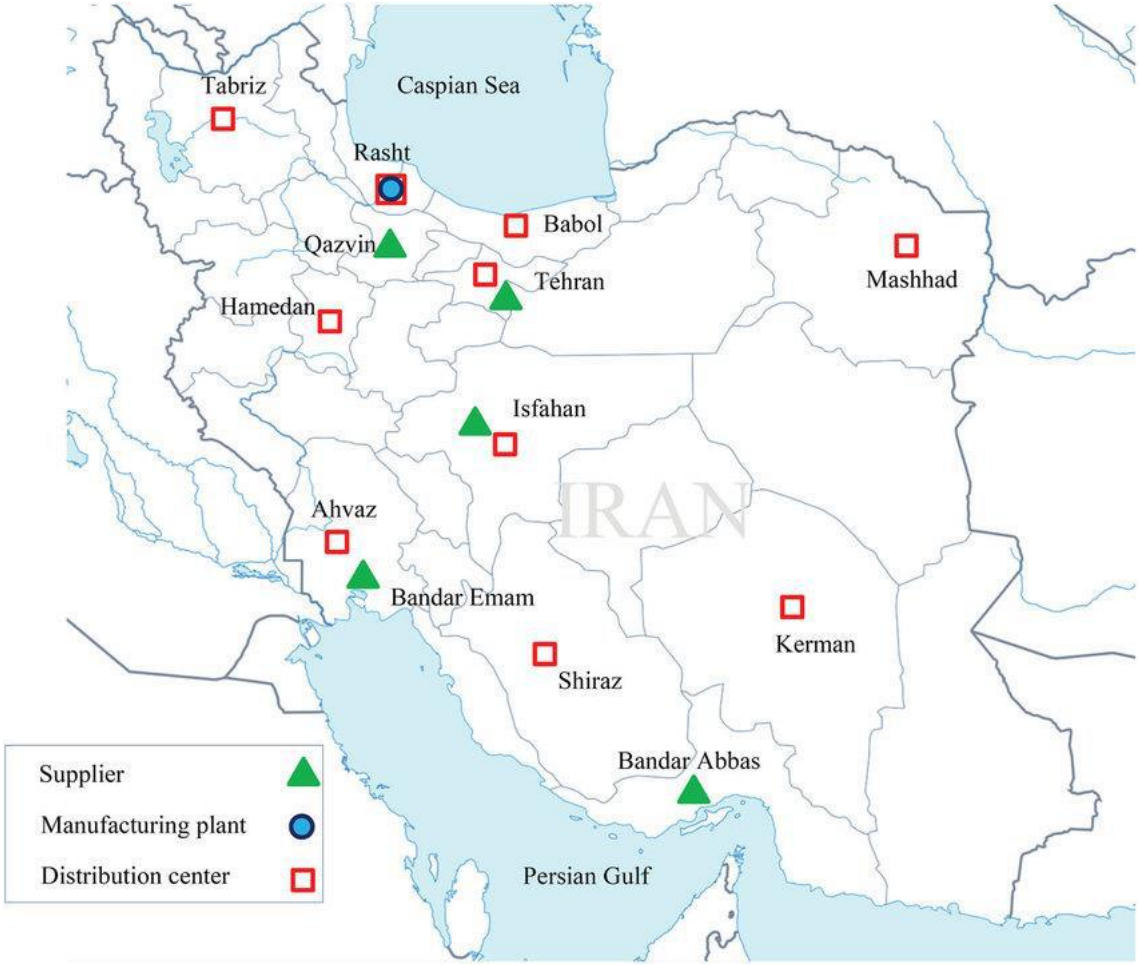

Figure 2-1: IRAN Map.

2-3 Company's Organizational Chart

It is a diagram that depicts a company's internal layout by describing the roles, responsibilities and relationships between individuals within an entity. This company is in a functional structure that includes a CEO, the board of directors and eight important departments naming Management Engineering and Researches, Total quality management, Management informatics and systems development, Financial and Accounting Management, Materials Management, Human resource management, Marketing and sales management and Logistics and supply chain management. This organizational structure authorizes for a high degree of specialization for employees and also each separate department is managed independently.

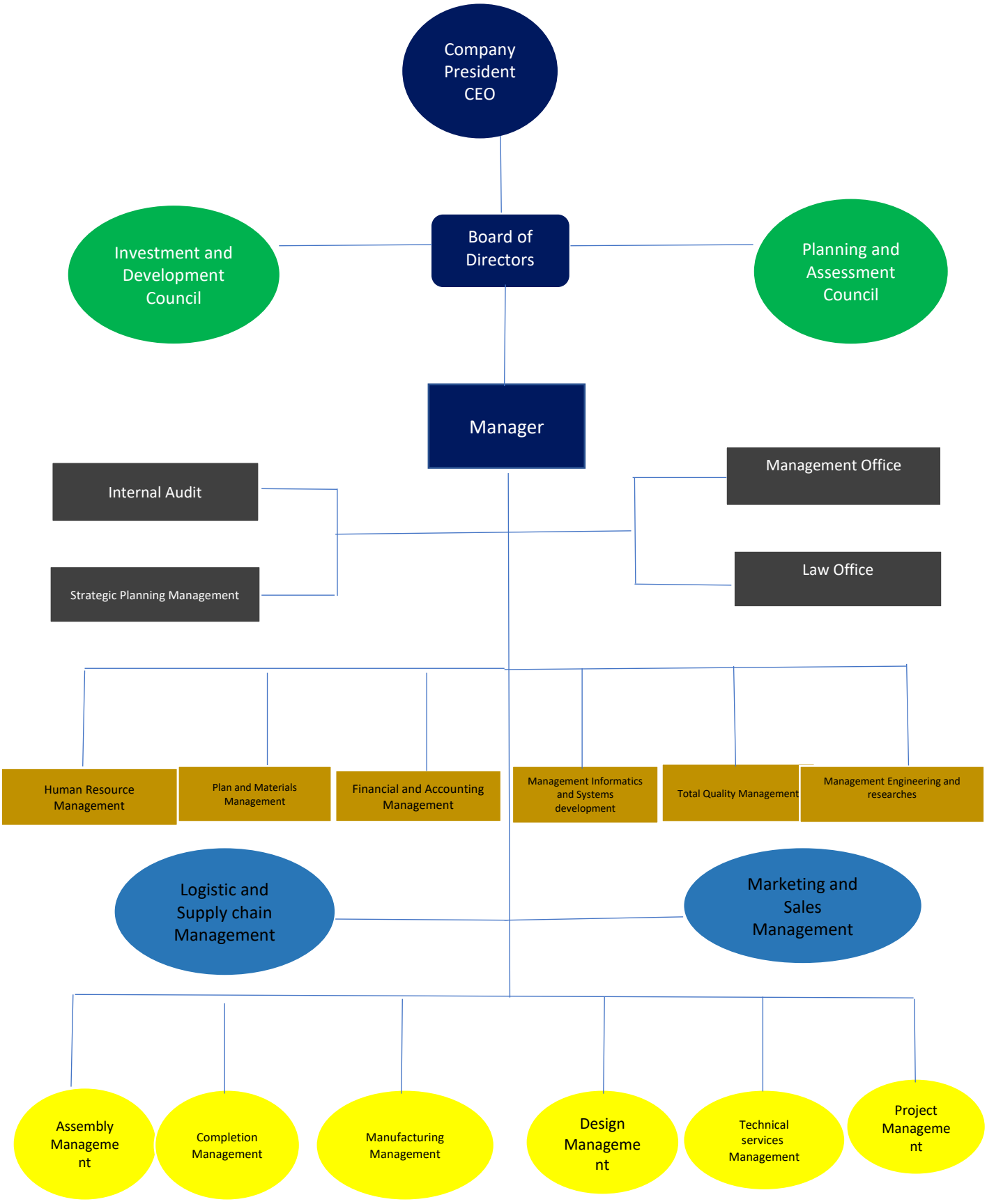

Figure 2-2: Organizational Chart.

Figure 2-3: Layout Drawing.

2-4 Company's Achievements

- ✓ Received the title of " Entrepreneur Model" for many years
- ✓ Received the title of "Quality Sample Unit in Guilan Province" for consecutive years
- ✓ Obtaining a certificate of eligibility of the partner laboratory at the national level by the Iranian Office of Standards and Industrial Research
- ✓ Obtaining ISIRI national standard from Iran Institute of Standards and Industrial Research
- ✓ Obtaining ISO9001-2000 certification from SGS Switzerland
- ✓ Obtaining safety certification from TUV Austria and CPT certification from Russia
- ✓ Obtaining a certificate of commitment to organizational excellence EFQM
- ✓ Extension of the International Certificate of Management of the S BSB Cert5 of Canada
- ✓ International ISO-10004: 2012 Customer Satisfaction Assessment Certificate
- ✓ Renew International Certificate of Customer Complaints Management Standard ISO-10002: 2004
- ✓ Standard Thanksgiving Tablet Top Fan Product Quality
- ✓ European Standard CE Cycle Meat Product Certificate

2-5 Quality Policy in PARS KHAZAR Industry Company

- ✓ ISO-9001: 2008 Quality Management System
- ✓ ISO-10002: 2004 Customer Complaints Management System

PARS KHAZAR Industrial Company, as a leading company in the production of home appliances in Iran, is trying to improve its position in the category of a reputable international company and use its efforts to reach global markets. In this regard, the company offers timely, flawless production and presentation of new and diverse products with the best possible quality and competitive price to improve customer satisfaction and create a culture of respect for the client in the organization. The company considers its customers as business partners and supports them by establishing permanent communication and providing extensive after-sales service. trustworthy, honesty, loyalty, hardworking, innovation, capability and commitment to the goals and strategies of the company at all levels are the main assets of the company and the development of capabilities, skills, all-round participation and compensation for their role and performance are always considered. Global manufacturing and competitiveness have led to an obvious need for international conformity and consensus in establishing quality control methods. This need leads to the establishment of

the ISO 9000 standards series on quality management and quality assurance standards, as well as the QS 9000 standards. A company's registration for these standards, which is a quality process certification and not a product certification, means that the company conforms to consistent practices as specified by its own quality system. ISO 9000 and QS 9000 have permanently influenced the manner in which companies conduct business in world trade, and they are now the world standard for quality.

2-6 Company's Units

In general, the company consists of the following two units:

1- Production unit 2- Technical unit

2-6-1 Construction Part (Production Unit)

The production unit function includes responsibility for executing and implementing the manufacturing system towards producing the product and includes workshops Such as press and guard, turning, casting and sawing, plating, painting, assembly and etc. Due to a manufactured item routinely starts with raw materials, which are then subjected to a sequence of processes to make individual products, it has a certain value. For Instance, clay has some value as mined, but when it is constructed into a product such as cookware, pottery, or a cutting tool, value is added to the clay. (Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology 6th, 2017)

2-6-2 Technical Part

The role of this unit is to meet the needs of the production unit in terms of industrial devices and machines and Includes sections Such as development and research plan, quality control, engineering, planning, etc.

2-7 Procedure of Implementation Total Quality Management (TQM) in PARS KHAZAR Company

Customer satisfaction and meeting his needs for products is the main factor in increasing sales in any company and bringing the company to maximum profit, so the quality of products is essential. Because in today's world of competition, where the variety of products and brands in the markets is great, and also to compete with foreign products and brands, "retaining"

current customers with great importance is little difficult. Another point is that the best advertisement for any company is the advertisements that the customers of that company present to their family members, acquaintances and friends. Satisfied customers get more customers for the company. In modern manufacturing technology, many parts are processed to a high degree of precision and thus require measuring instrumentation with several features and characteristics. The principal methods of measurement and the characteristics of the instruments used in manufacturing are so important for an industry company.

Generally, measurements should be done after the part has been produced— this approach known as post process inspection. It defines checking the dimensions of what has been produced or is being produced and determining whether those dimensions comply with the specified dimensional tolerances and other specifications. Added to this, Tolerances are main keys because of their effect on the proper functioning of a product, part interchangeability, and manufacturing costs. By and large, the smaller the tolerance, the higher are the production costs. Temperature control is very substantial, particularly for making measurements with precision instruments. (Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology 6th, 2017)

A wide variety of instruments and machines is available to accurately and rapidly measure the preceding quantities on stationary parts or on parts that are in continuous production. Due to significant and continuing trends in automation and the computer control of manufacturing operations, modern measuring equipment is now an integral part of production machines. (Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology 6th, 2017) the measurement instrument can measure the overall dimensions, thickness, and depth of a variety of parts.

Figure 2-5: Digital Caliper.

Figure 2-4: Electronic gage.

Execution process of TQM in this company includes Quality control (QC), Quality Engineering (QE) and, Laboratory Testing and Calibration. The scope of the implementation method of total quality management, including PARS KHAZAR Industrial Company and the products of PARS KHAZAR companies, should be maintained and implemented.

Total quality management (TQM) is a system which emphasizes the concept that quality must be designed and built based on a product. It is a system approach, in that both management

and employees make a concerted effort to consistently manufacture high-quality products. Defect prevention rather than defect detection is the major goal here. Leadership and teamwork in the organization are essential. They ensure that the goal of continuous improvement in manufacturing operations is foremost, because they reduce product variability and they improve customer satisfaction. The TQM concept also needs control of the processes, and not the parts produced, so that process variability can be decreased and no defective parts are allowed to continue through the production line. (Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology 6th, 2017)

2-7-1 References for TQM Implementation in PARS KHAZAR Company

- ✓ Method of implementation, control and maintenance of information
- ✓ Execution method of identifying process risks and its management
- ✓ Executive method of process management and analysis of organizational indicators
- ✓ Guidelines for identifying and generalizing the needs and expectations of the organization's stakeholders
- ✓ products standards (factory, national and international standards)
- ✓ Bill of Materials (BOM) List of all materials required in a process together with the quantities required.
- ✓ Maps and technical specifications of engineering and research
- ✓ Coding instructions for testing and measuring devices
- ✓ Equipment calibration instructions
- ✓ Executive method of controlling items (materials / parts / product)

2-7-2 Quality Control Unit Process

The activities of this section include improving the quality of the supplier and inspecting the imported items in the implementation of quality control during the process and final control of Products and Materials. Quality control and improvement includes the collection of activities used to ensure that the products and services meet requirements and are improved on a continuous basis. Since variability is an important source of poor quality, statistical techniques, including SPC and designed experiments, are the major tools of quality control and improvement. Quality progress is often conducted on a project-by-project basis and involves teams led by personnel with specialized knowledge of statistical methods. Projects should be selected so that they have significant business impact and are connected with the

overall business goals for quality identified during the planning process. In this part, product quality expert analyzes the all completed forms of including Inquiry reports of materials and equipment according to Quality control standards.

2-7-3 In-Process Quality Control Checks (IPQC)

In-process quality control (IPQC) is the process that is carried out before, after and during the manufacturing of the finished product. The function of In-process quality control is monitored and if necessary, modification and adjustment of the manufacturing process in order to comply with the specifications. Many factors are responsible to give assurance of the quality of product. One of them is In-Process Quality Control Checks (IPQC). many operations are involved during the manufacturing of a finished product and it is understood that quality is the responsibility of all the persons involved in the manufacturing and also Quality cannot be tested into products; it should be built-in (i.e. by design) and verified during the process to the extent possible rather than depend alone on end product testing. Hence it is necessary to check and control the critical points of the product during the manufacturing and up to the final packing of the product Parts. At this section, TQM Operator gives Feedback from final control and analysis of daily quality reports. It sends detailed reports to quality units through the analysis of forms and reports submitted from production units and periodic visits and statistical quality control.

2-7-4 Calibration

The purpose of calibration is to create an effective system to control the accuracy of metrological parameters of test devices and measuring instruments and all equipment which their performance affects the quality of the process. This is used to ensure that the measurements made conform to international standards. Laboratories and manufacturers in every field depend on the technical competence of calibration operators to ensure accurate and consistent measurements. Calibration of instruments and processes is necessary for checking their performances against known standards. This provides stability in readings and reduces errors in order to validate measurements. Calibration can be defined as ‘a set of operations to establish the relationship between values of quantities indicated by measuring instruments and systems under specified conditions. Therefore, calibration assures that devices and processes meet expected performance specifications within globally acceptable levels and accuracy.

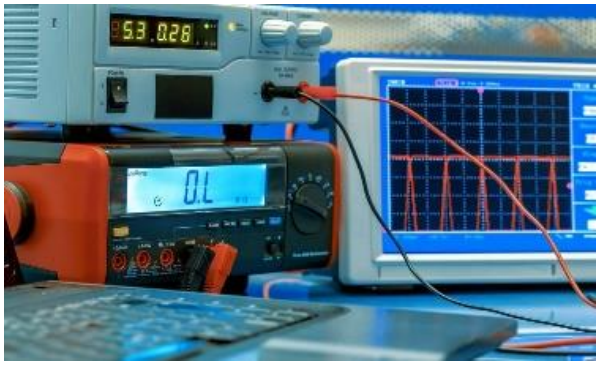

Figure 2-6: Multi meter calibration.

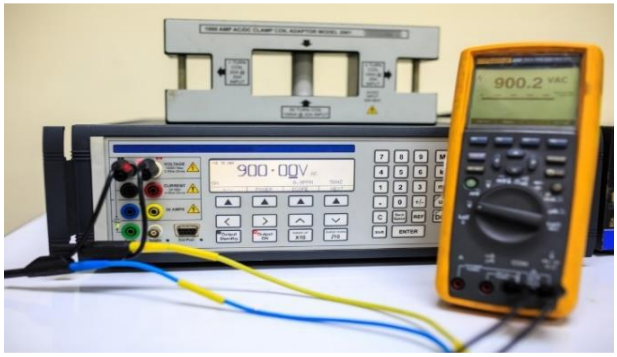

Figure2- 7: Calibration Device.

2-7-5 Quality Engineering (QE) Section in PARS KHAZAR Company

The duty of this part is to provide the necessary quality software and hardware according to the goals of TQM to improve and enhance the quality of products / services considering the "stakeholders" of the organization, the employers, the customers and the suppliers. The main tasks:

- ✓ Timely and correct performance of tests and inspections required by the product, which are mentioned in control plans or other technical documents.
- ✓ Evaluate the quality of the output product and extract the quality data and analyze it.
- ✓ Perform product tests and measurements according to control plans
- ✓ Measuring the power of production processes and providing appropriate solutions to increase the capability of machines
- ✓ Implementation of statistical control process (SPC)
- ✓ Training of production personnel in quality matters
- ✓ Find incompatibility in products
- ✓ protection of laboratory equipment and control tools affecting product quality

2-7-6 Statistical Methods of Quality Control

Due to the numerous variables involved in manufacturing processes and operations, the implementation of statistical methods of quality control is effective. The following list describes some of the commonly observed variables in manufacturing:

- ❖ Machinery performs differently depending on its quality, age, condition, and maintenance; thus, older machines tend to chatter and vibrate, are difficult to adjust, and do not maintain tolerances as well as new machines.
- ❖ The effectiveness of metalworking fluids reduces as they devalue; thus, tool and die life, surface finish and surface integrity of the work piece, and forces and energy requirements are affected.
- ❖ Environmental conditions, such as temperature, humidity, and air quality in the plant, may change from one hour to the next, affecting the performance of machines and workers.

Statistical process control (SPC) is an intense complex of problem-solving tools which is effective in achieving process stability and improving capability through the reduction of variability. A set of statistical tools that is based on analysis of observations of random samples taken from process output products, Judges about being under control or that the process is out of control.

If a product is to meet or exceed customer expectations, normally it should be constructed by a process that is stable or repeatable. More precisely, the process must be capable of operating with little variability around the target or nominal dimensions of the product's quality characteristics.The steps of SPC components in a production line are such that it is responsible for SPC Operator in different product lines to Analyze data according to the ratio of defective items, value added of products, product customer sensitivity, Tolerance sensitivity, product engineering characteristics and etc. Prioritizing products and execute SPC are significant actions in order to achieve high efficiency. SPC seven major tools are

1. Histogram or stem-and-leaf plot
2. Check sheet
3. Pareto chart
4. Cause-and-effect diagram
5. Defect concentration diagram
6. Scatter diagram
7. Control chart

2-7-7 Control Chart

The control chart is one of the important techniques widely used for SPC analysis. It is a diagrammatic illustration that provide useful information relating to improving process. Furthermore, it depicts details about the quality characteristics of products. The chart includes a center line that shows the average value of the quality characteristic. Two other horizontal lines, called the upper control limit (UCL) and the lower control limit (LCL), are also shown on the chart. Being the points plot within the control limits, the process is assumed to be in control, and no action is necessary. However, a point that plots outside of the control limits is clarified as evidence that the process is out of control, and investigation and corrective action are required to find and eliminate the determinable cause or causes responsible for this behavior.

To run SPC on the PARS KHAZAR Industry Company production line, eleven steps must be taken:

1. We must first become familiar with each component of the workstation. This information can be obtained by studying the documents and obtaining from physically attending at each workstation. This information includes the type of production operation, specifications, a history of device failure, etc.

2. Recognizing the engineering characteristics that in fact in this step we should highlighting the quantity and quality of the product, after that we should determine the lower control limit (**LCL**) and the upper control limit (**UCL**) from the map of products.

3. We analyze the engineering characteristics of products according to the history of defective products; we also rank the tolerance sensitivity relating to LCL and UCL

4. Select the appropriate control chart

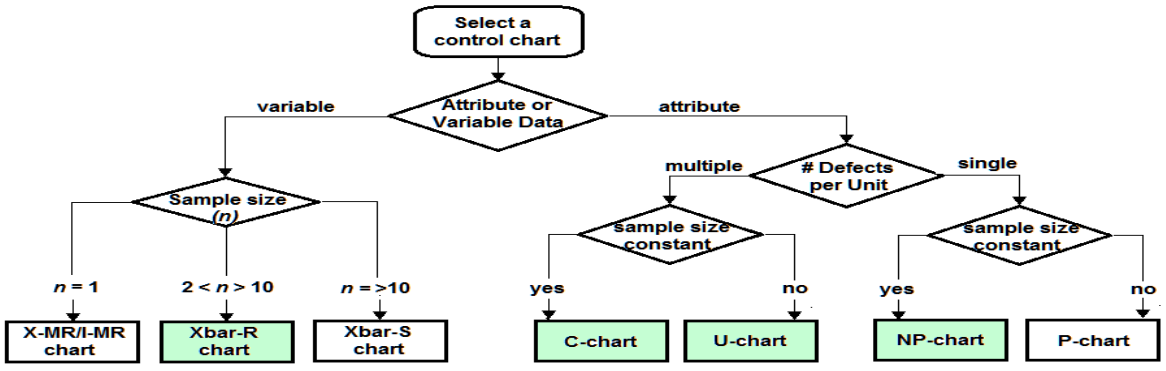

Figure2-8: Flowchart.

5. Procurement of data collection system: In this step we must specify according to the attribute of each Engineering characteristics such as tolerance limits and tolerance accuracy of what measuring tool-system should be used, what training courses should the production operator take and what skills should he have?

6. Design a sampling method, in this step we have to specify in what period of time we should take a random sample at each workstation and what is the size of the random sample.

7. Collecting m random sample of n, to draw an experimental control chart.

8. Assess the ability of the process, here we need to examine how our process in producing faultless products is capable.

Pp = Process Performance. A simple and straightforward indicator of process performance.

Ppk = Process Performance Index. Adjustment of Pp for the effect of non-centered distribution.

Cp = Process Capability. A simple and straightforward indicator of process capability.

Cpk = Process Capability Index. Adjustment of Cp for the effect of non-centered distribution.

If Cpk is equal to zero, there are exactly 99.73% cases of producing valid and faultless products.

If Cpk is greater than zero, more than 99.73% of manufactured products are faultless. If Cpk is less than zero, less than 99.73% of manufactured products are faultless and valid. it is required that instructions for how to inspect parts, time interval between sampling, Random sample size, how to record observations as well as rules that are out of control, analyzed by quality control engineer and should inform QC technician.

In this section, they analyze the quality of products according to SPC graphs, they use an electronic digital caliper for measurements the indicators and after that they send them directly to the software. This is like Minitab software but simpler than minitab.it is designed by one of the Electric and Computer Engineer in the PARS KHAZAR Industry Company. This software shows us that the products important characteristic is in control or out of control. Using SPC, manufacturing engineers or production supervisors can acquire and analyze statistical data about the manufacturing process. The data collected is useful for determining whether characteristics of the product or process conform to specifications and meet acceptable quality levels.

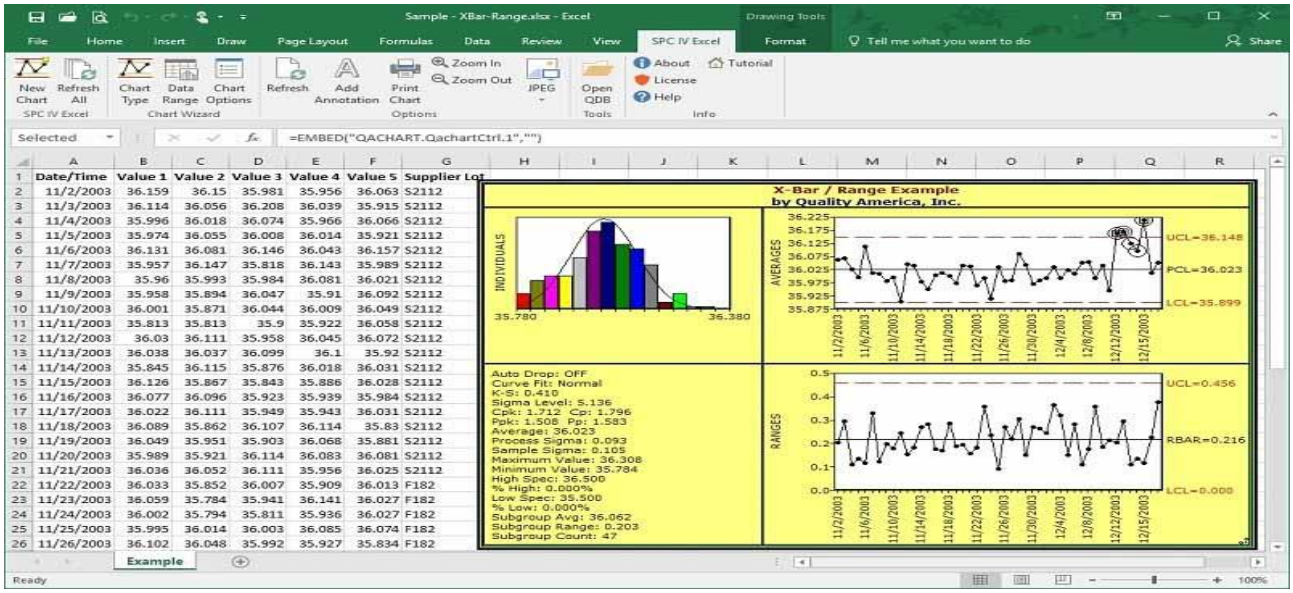

Figure 2-9: SPC (Excel Report).

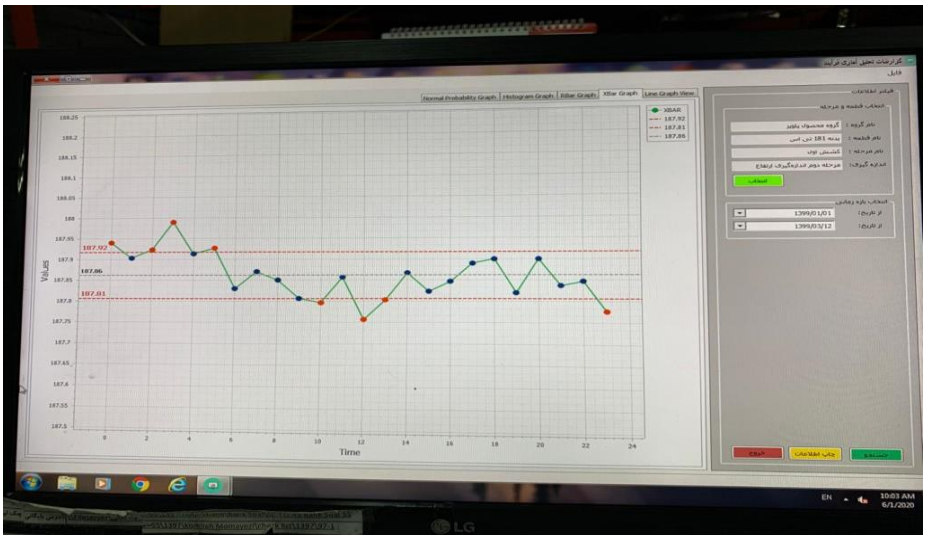

Figure 2-10: X-Bar.

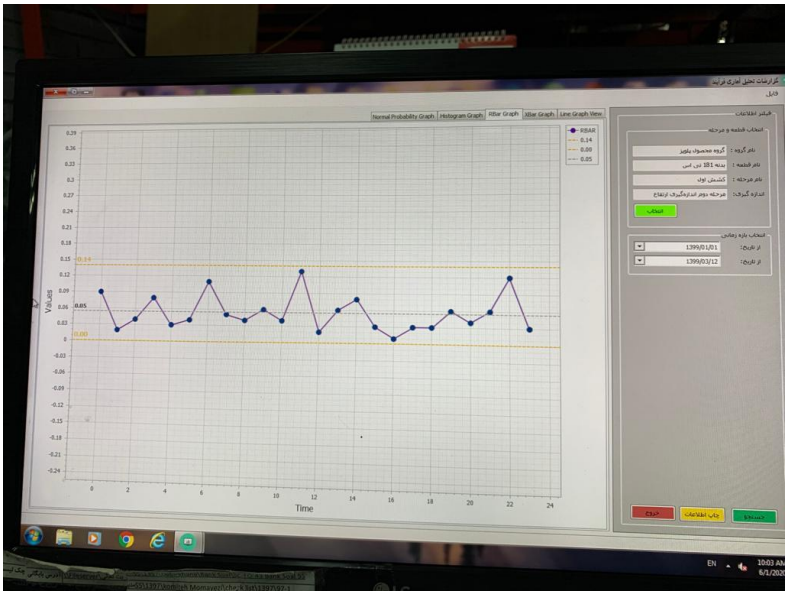

Figure 2-11: R-Bar.

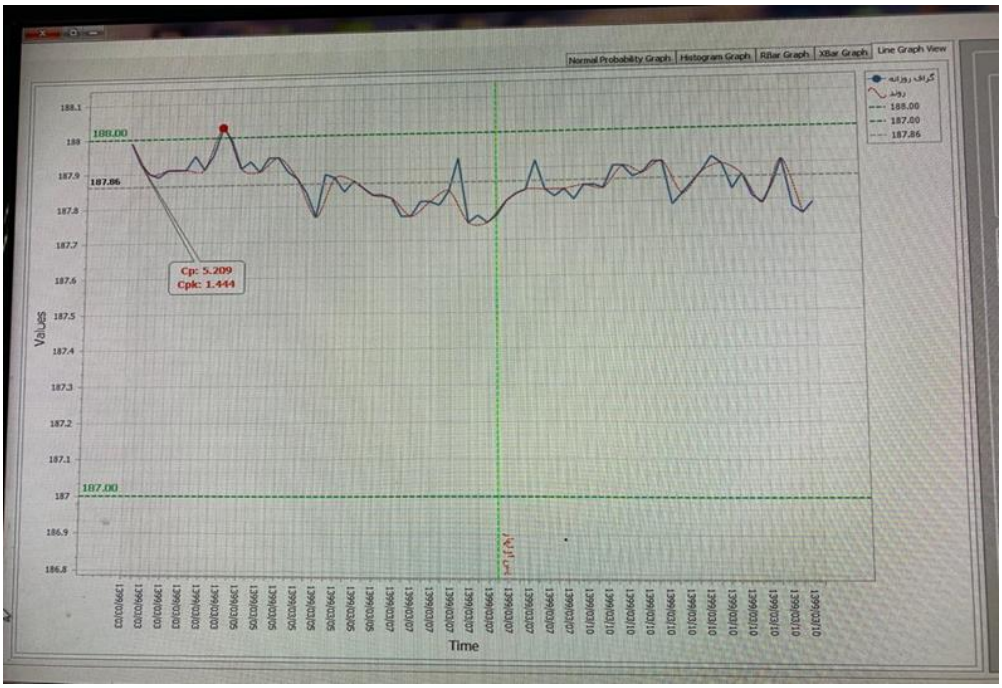

Figure 2-12: Line Graph View.

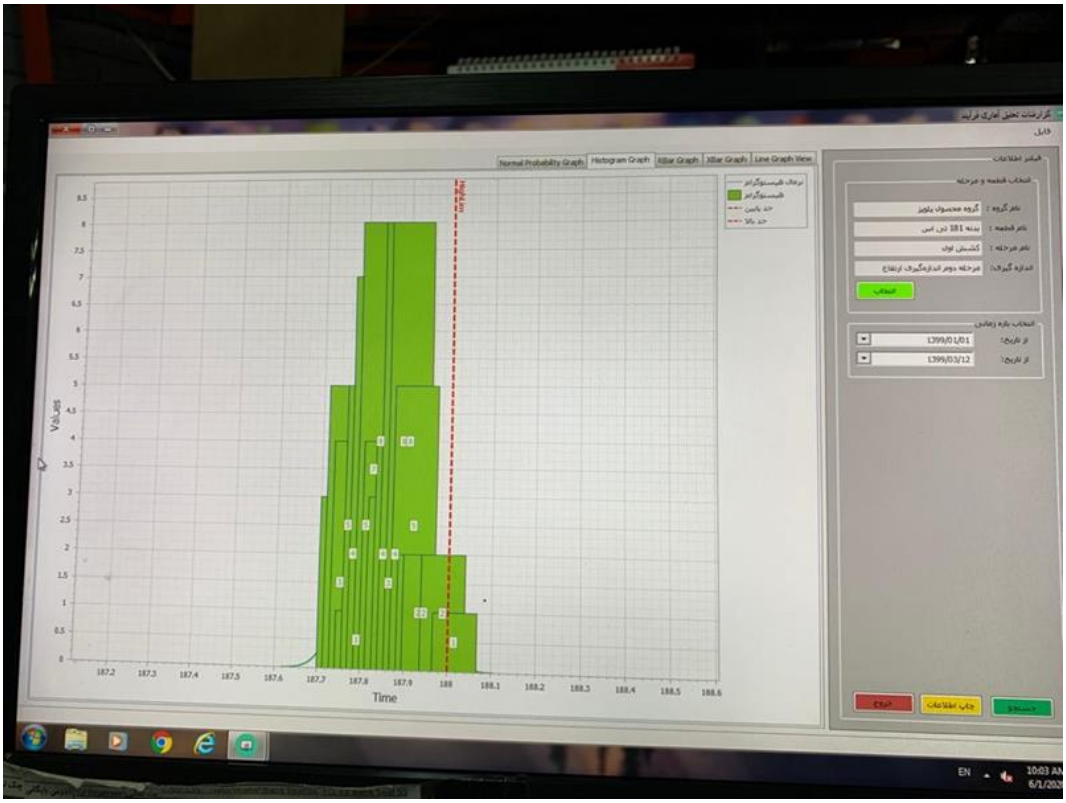

Figure 2-13: Histogram Graph.

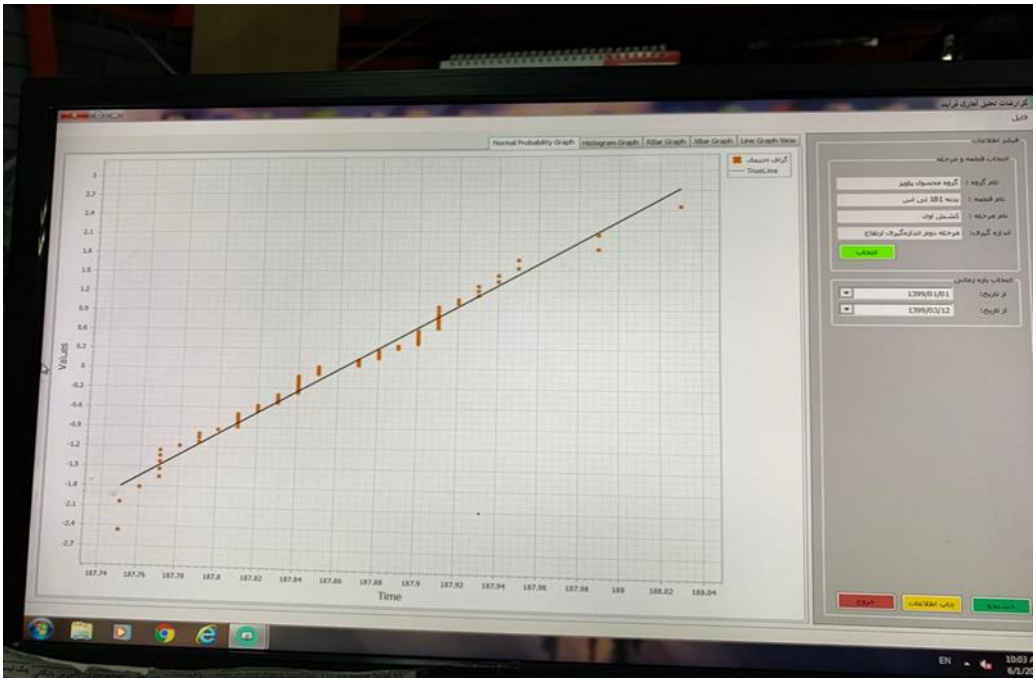

Figure 2-14: Normal Probability Graph.

Figure 2-15: Electronic Digital Caliper.

At the quality control laboratory, operators use a measurement device for analyzing the products power and resistance for improvement the efficiency. They can obtain information about if product can satisfy the consumer needs or not. Added to this, they test the product performance according to the high resistance and specified time.

Figure 2-16: Power Measurement Device.

Figure 2-17: Energy Efficiency Measurement for Rice Cooker.

2-7-8 Performing Statistical Quality Control Analysis Using MINITAB Software

This software is a statistical software that has the ability to execute statistical calculations from basic to advance. Compared to other statistical software, in some fields of statistics, including the application of statistics in industry and in economics, it has special and higher capabilities. Minitab is a statistical software that frequently integrated with the implementation of six sigma, CMMI (Capability Maturity Model Integration) and other statistics-based process improvement methods. (Wang Ruci, 2015)

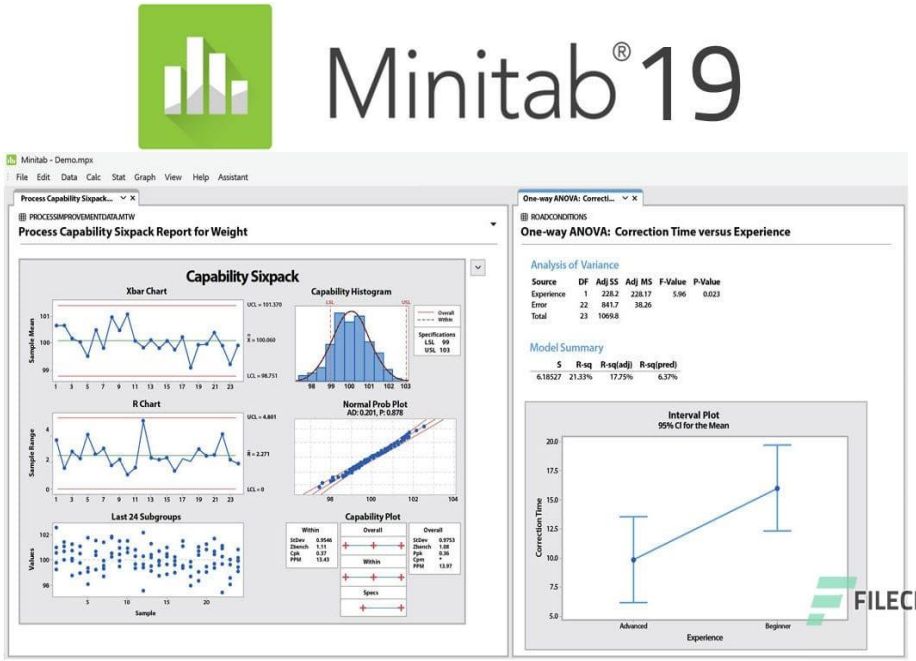

Figure 2-18: Minitab 19.

To draw the diagrams, proceed as follows and then select the desired diagram:

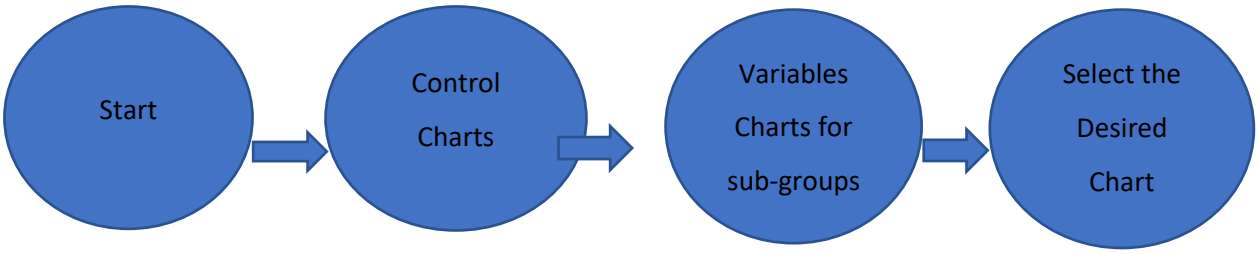

Figure 2-19: Graphing process.

First, we draw the R diagram, if the R diagram is in control, we draw the X bar diagram, but if the diagram R is out of control, we delete the data that are outside the standard Range and Draw it again, this action will continue until the R diagram will come into the control, then draw the X bar diagram.

As we can see, data 1 is not under control, so that data must be deleted.

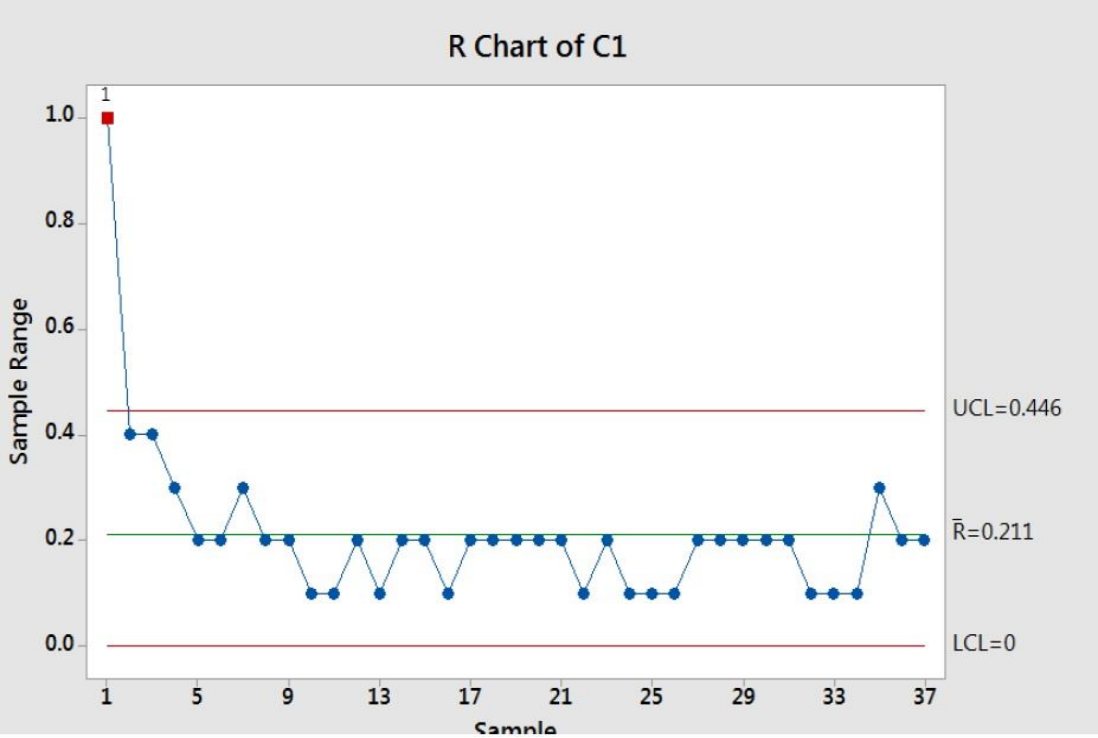

Figure 2-20: Diagram 1.

We see that the two data are in the control range, which the software shows in red, and that it means it is not completely under control so delete it again and set new limits.

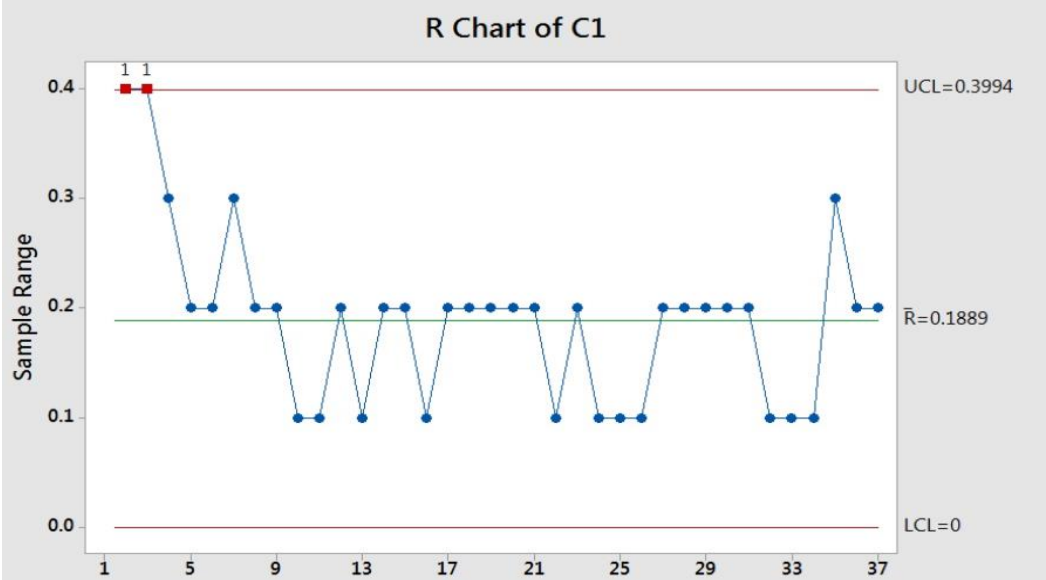

Figure 2-21: Diagram 2.

As can be seen, the R diagram is under control, so with this data, the X bar diagram is drawn.

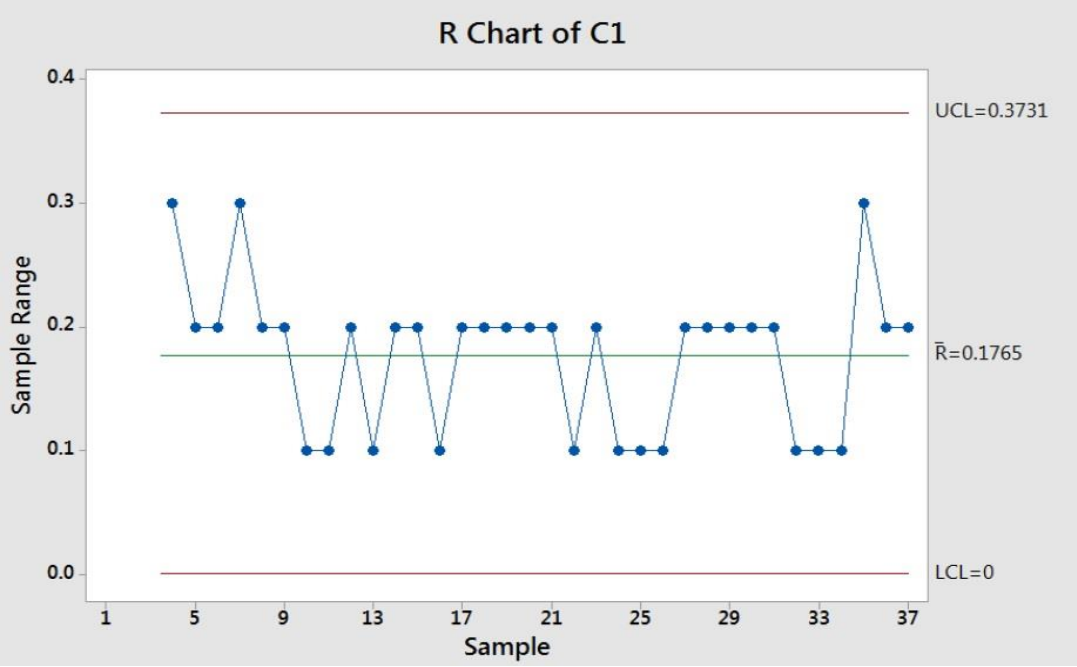

Figure 2-22: Diagram 3.

It is observed that the data is not under control and the reason can be a change of shift or change of raw materials or change the device settings.

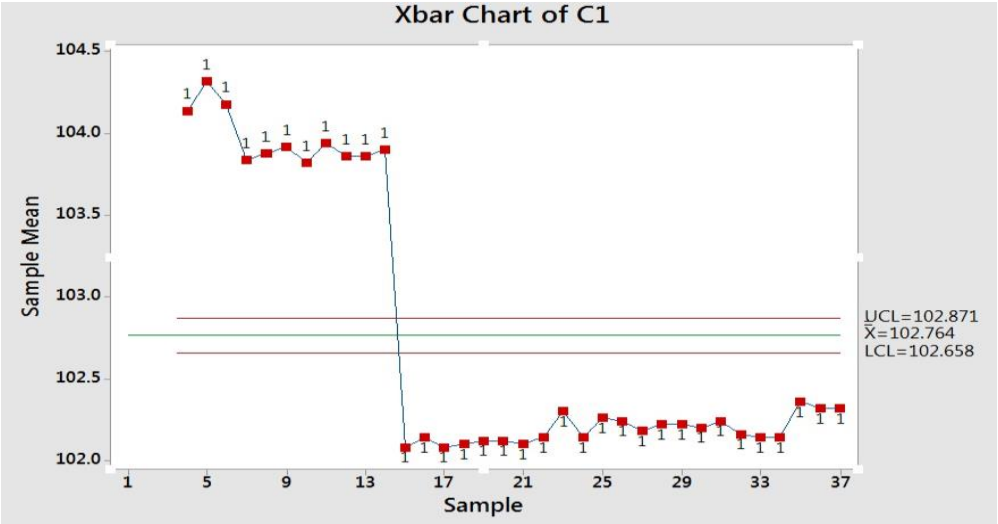

Figure 2-23: Diagram 4.

The R and X bar diagrams are as follows:

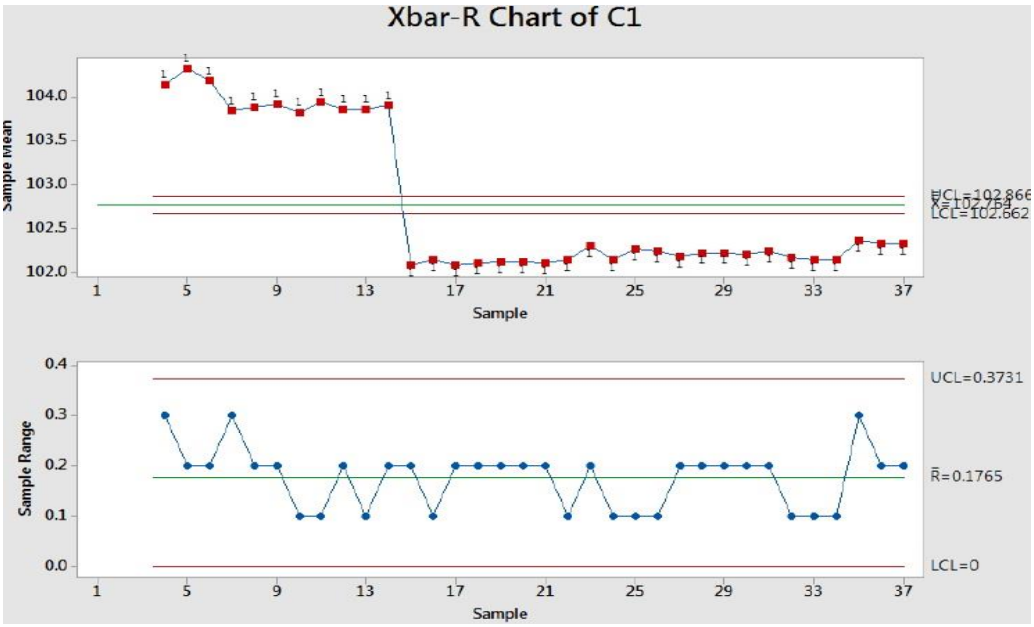

Figure 2-24: Diagram 5.

X bar-S Diagram:

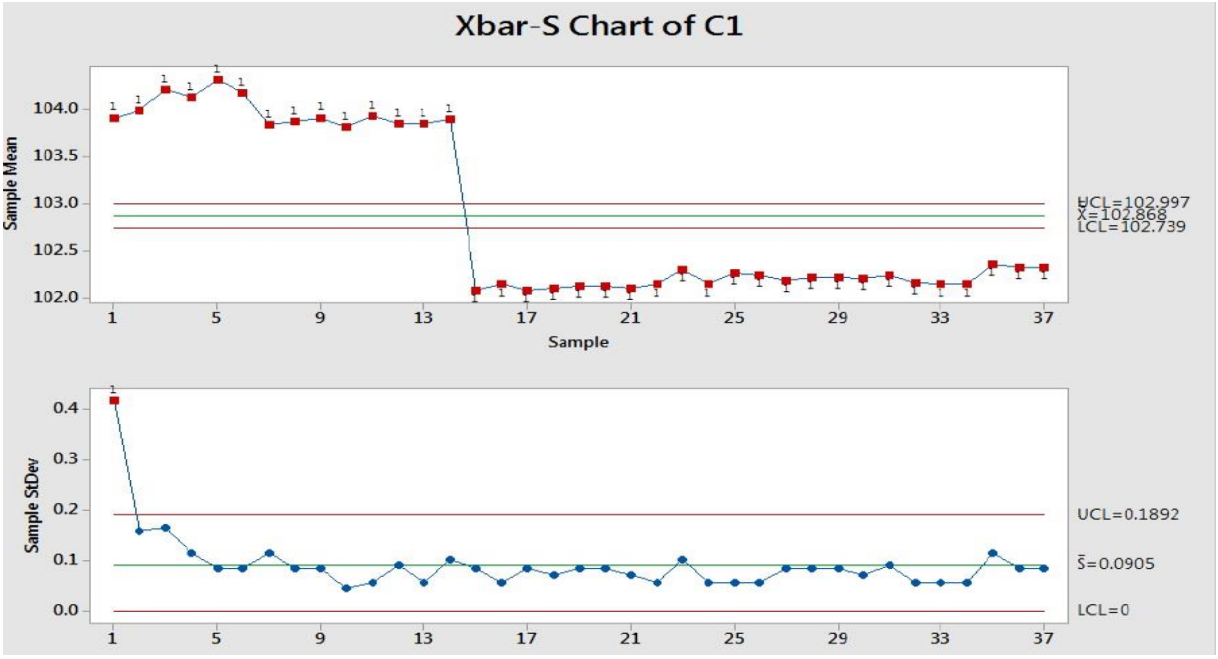

Figure 2-25: Diagram 6.

Delete data one from the data and redefine the control Range. Now we have S under control.

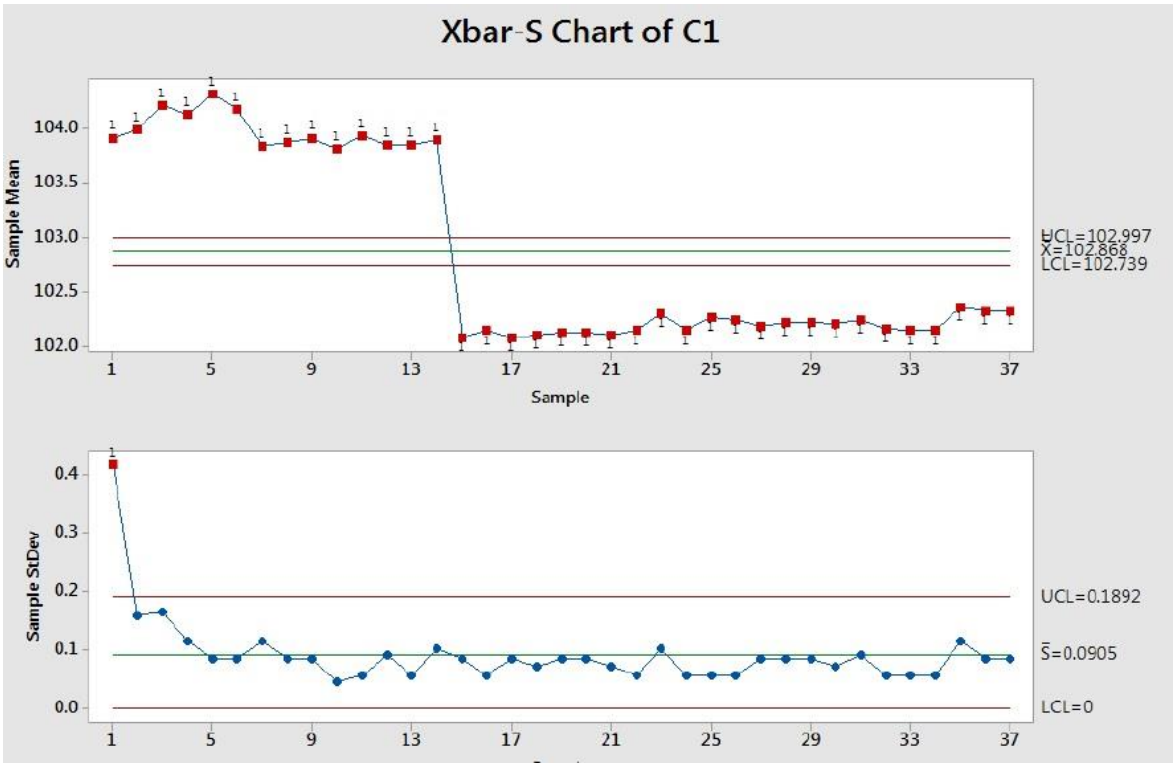

Figure 2-26: Diagram 7.

We see that the s-chart is under control at this point, but the X bar diagram for reasons such as changing in work shift, changing raw materials or changing device settings is not under

control, as we see a sudden change From the sample onwards, the size has been significantly reduced, which is likely based on the evidence Due to changing in operators work shifts.

2-8 Reliability of Products and Processes

In this Company, they use FMEA Method (Failure Mode and Effects Analysis) for analyzing the Products and processes reliability for a specified period. It is a qualitative and systematic methodology, typically designed within a spreadsheet. The PARS KHAZAR industry company use this engineering technique to determine, identify and eliminate known and potential failures, problems Originated from systems and process before they reach the customer.

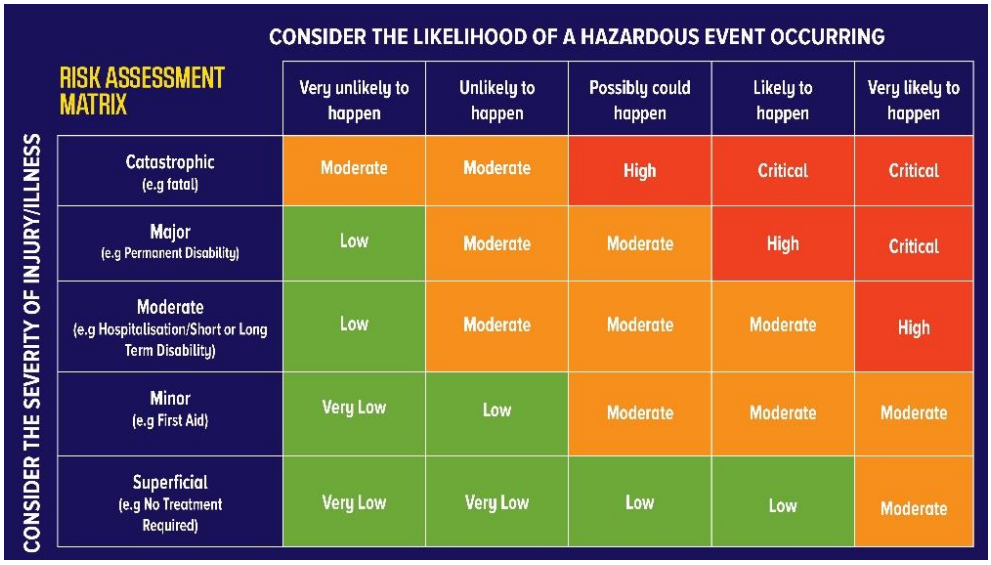

Figure 2-27: Risk Assessment Matrix.

2-9 Automated Inspection

Traditionally, individual parts and assemblies of parts have been manufactured in batches, sent to inspection in quality-control rooms (post process inspection) and, if approved, placed into inventory. If the parts do not pass the quality inspection, they are either scrapped or kept and used on the basis of having a certain acceptable deviation from the standard. In contrast, automated inspection uses a variety of sensor systems that monitor the relevant parameters during the manufacturing operation (online inspection). Using the measurements obtained, the process automatically corrects itself to produce acceptable parts. Thus, further inspection of

the part at another location in the plant is unnecessary. Parts also may be inspected immediately after they are produced (in-process inspection).

Figure 2-28: Automated Inspection.

2-10 Six Sigma in the Company

Six sigma is a set of statistical tools based on the well-known total quality management principles of continually measuring the quality of products and services. (Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology 6th, 2017) According to Company rules, measurement systems play an important role both in determining the final quality of product, but also in allowing a Six Sigma program to achieve breakthrough performance. The company implement Six Sigma as a problem-solving methodology especially useful for dealing with recurring problems in business processes. Six Sigma focuses on improving quality (i.e., reducing waste) by helping organizations produce products and services better, faster and cheaper. In more traditional terms, Six Sigma focuses on defect prevention, cycle time reduction, and cost savings. This company uses some software application such as Minitab, Microsoft Project, Excel, and Process Model.

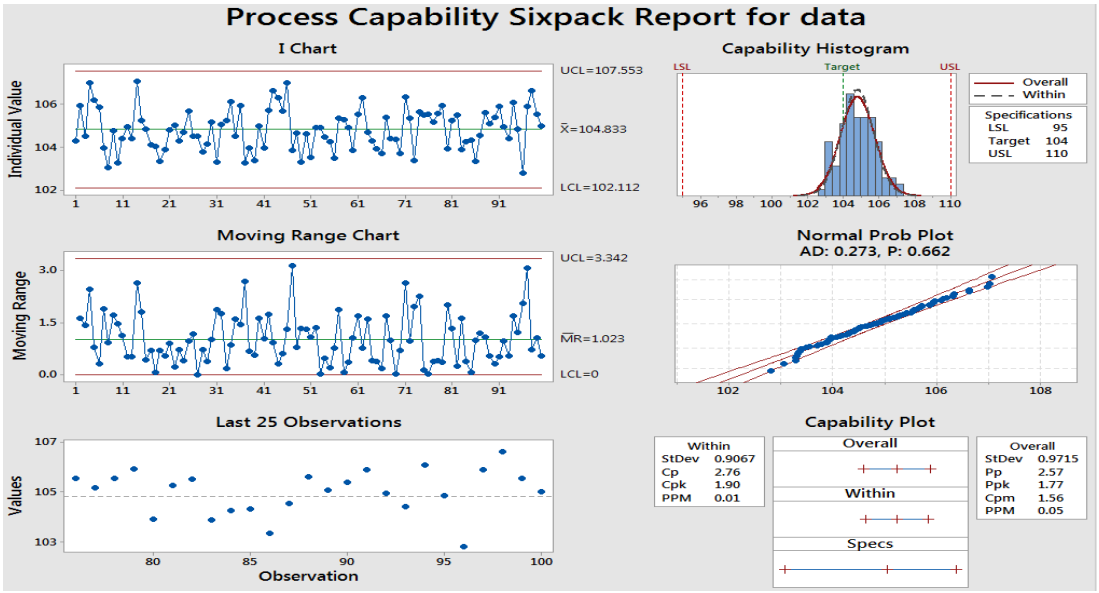

Figure 2-29: Six Sigma Statistical Analysis.

2-11 Lean Production and Agile Manufacturing

Lean production is a method about assessment of each activity of a company, with the purpose of minimizing waste at all levels as well as the elimination of unnecessary operations that do not supply any added value to the product being manufactured. This company optimizes all the production processes in order to achieve the maximum efficiency and also another goal of this method is to minimize the costs incurred in each operation. In this method, Team working among the company's workforce and management as well as alliance between them are so important for improving the profitability. Kaizen and TPM (Total productive Maintenance) are two key concepts for PARS KHAZAR Industry Company towards maximizing the productivity.

Figure 2-30: Lean Production.

2-12 Chapter Summary

In this chapter, we focused on Introduction of the PARS KHAZAR Company, company organizational structure, company achievements, Quality policy in PARS KHAZAR Company, company units and also Procedure of Implementation TQM in this company. Added to this, some important topics of Quality Engineering such as Six Sigma and Statistical methods of quality control were presented.

Chapter 3: Expressing the Company's Problems in the Context of a Conceptual Model of Research

3-1 Introduction

This chapter introduces the purpose of the dissertation and a critical review of the research literature on the various concepts of total quality management (TQM), sustainable development and green innovation. In this chapter, the researcher intends to analyze the problems relates to the process of the impact of key elements in total quality management on the sustainable development of the company by emphasizing the role of green innovation in the operational environment of PARS KHAZAR Industrial Company.

3-2 The objective of Thesis (Problem Statement)

The quality of services and production facilities is still the main cause of many problems such as low productivity, low quality and so on. The end result of these issues is significant defects or changes in the performance or expected appearance of the final product but other issues including, problems in supply chain management, long lead times, weak Strategic plan and excessive inventory. PARS KHAZAR industry company wants to enhance the quality of its products due to high competition in the market. Total Quality Management can be a strong tool to support the company in order to achieve this fundamental goal. Moreover, Implementing Total Quality Management according to the company’s goals and conditions would face with difficulties and it would not carry out as a fix structure in any organization. But unfortunately, this strategy has not noticed vigorously in Iran industries especially in PARS KHAZAR industry Company. In general, good quality performance has always been a

key strategic factor for business success, but now more than ever you need to compete successfully in 21st century global markets. PARS KHAZAR Industrial Company, like many other manufacturing companies, has adopted a wide range of techniques in response to some internal and external problems in order to achieve sustainable development of the company. These approaches can include system and quality management standards, the advent of total quality management (TQM), business process reengineering (BPR), green innovation, lean thinking, Six Sigma, statistical process control, and more. (Total Quality Management and Operational Excellence, John S. Oakland, 2014) Generally, the quality is substantial in any part of product or services. The customer always chooses a product or service that is of high quality. If PARS KHAZAR Industrial Company can implement TQM approaches efficiently, it will bring quality of performance financially, operationally, organizationally and staff. TQM is one of the business management strategies that plays an essential role in gaining quality awareness in all processes of the organization (Abdul, 2018). With the growing competition and the difficulties of globalization in the manufacturing industry, it is expected that by negatively changing weather conditions and reducing sales margins and costs, pressure will be put on manufacturing companies, as well as quality management methods as a goal to stay in business (Zakia Mohad Zaidi and Nourazova Ahmad, 2020). Global competition continues to grow, and companies are realizing the increasing demand for quality products and services from customers, and the only way to survive is to trade with high quality services and products. Which meets customer expectations (Khadka & Maharjan, 2017). One of the important goals of PARS KHAZAR Industrial Company is to maintain a competitive advantage and this is a real challenge for this company. Therefore, PARS KHAZAR Industrial Company wants to respond to customer needs efficiently as well as achieve sustainable development. In order to improve organizational performance, PARS KHAZAR Industrial Company must adopt several useful strategies such as TQM, Lean Thinking as well as Green Innovation. In recent years, the environment has taken on a different meaning and can no longer be explained by old patterns and models. Today, the environment encompasses all the issues raised in industry, culture, economics and politics. In this case, when it is said that the environment, as in the past, is not specific to pollution or wildlife, but contains all the effects and aspects that somehow overshadow our human life. This trend has progressed to the point that in many developed countries, environmental planning is considered in the context of national planning. Sustainability is becoming an increasing issue for all industry companies and their managers understand the significance of the strategic approach of corporate

sustainability. Threats such as the exhaustion of natural resources, climate change due to overpopulation, and the accelerating economic growth of new industrial countries (South Korea, Singapore, India, Malaysia, Turkey, Iran, the Philippines, etc.) associated with negative environmental impacts are widely recognized. (Minjian Guo, Joanna Nowakowska-Grunt, Vladimir Gorbanyovand Maria EgorovaThey, 2020). We need Sustainable manufacturing as a manufacturing engineering's technique to manage these challenges. In the PARS KHAZAR Industry company Manufacturing technology is needed and should be developed for Economic Competitiveness, Environmental Compatibility and also Social welfare. This multidimensional goal system can be balanced by developing adequate economic, environmental and social criteria, with analysis of their interdependencies and application of that analysis for guiding technological innovation in respective economic, environmental and societal frameworks. (Sustainable Manufacturing Challenges, Solutions and Implementation Perspectives, 2017) to achieve goals of sustainable development, innovations are needed. (Walz, R.; Pfa_, M.; Marscheider-Weidemann, F.; Glöser-Chahoud, S., 2017) PARS KHAZAR Industry company needs Sustainable innovation to allows this company to match with technology. Sustainable green innovations in the production of high-quality innovative products that can reduce environmental impact. As long as environmental issues arise, the importance of sustainable green innovations will be significantly considered. (Hyung, K., Baral, p.) As a result of environmental concerns, the manufacturing industry has focused its efforts on implementing green innovations to reduce energy consumption, environmental pollution, ease of recycling, and the use of reproducible materials. (Dangelico, Pujari, and Pontrandolfo, 2017). The adoption and integration of green innovation has helped create more revenue opportunities and reduce environmental impact among multinational corporations such as Unilever, Ikea, Nike, Whole Foods and Tesla (Williams, 2015). Green innovation is another concept of environmental management that has recently been promoted with the aim of eliminating negative environmental outcomes (Chen, 2008; Chen and Chang, 2011). PARS KHAZAR Industry Company must focus on Green innovation In order to boost the future growth of its business as well as establishing new markets according to Green Systems strategies such as Green Technology Innovation and Green Management innovation. On the other hand, the present study helps innovation activities to potentially improve the company's green innovation and hence a comprehensive assessment considering green innovation for sustainable development of PARS KHAZAR Industrial Company (which includes innovation in green technology and Innovation in Green Management) is presented.

The number and importance of TQM factors vary from author to author. This leads to disagreement about the TQM design of the thematic literature (Dahlgaard-Park 2011). Problems arose when TQM dimension variation occurred. Many researchers have preferred to develop their own model instead of using a proven built-in model that has been tested by previous authors. As a result, agreement on a set of common TQM methods that define a wide range of TQM frameworks is controversial (Prajogo and McDermott 2005; Psomas, Vouzas and Kafetzopoulos 2014).In this dissertation, the researcher developed the six main dimensions of TQM based on the analysis of data collected from a comprehensive literature review and through meetings and interviews with managers at various levels of the company, especially the TQM management of PARS KHAZAR Industrial Company.

3-3 Conditions and Challenges of Total Quality Management in PARS KHAZAR Industrial Company

In the 1990s, TQM became one of the most attractive competitive strategies for companies seeking to make significant changes. In this regard, academic researchers and craftsmen in the field of production have drawn their attention to this issue and confirmed that the overall quality management encourages the company to focus on customer needs through the process of improvement and attention to cost improvement, quality and customer satisfaction. In PARS KHAZAR Industrial Company, the basis of total quality management is based on actively pursuing continuous improvement, understanding the attitude of customers within the organization and training and development in all organizational dimensions. But from the researcher's point of view, the philosophy of total quality management in PARS KHAZAR Industrial Company has its own problems and limitations. Researcher field observations in PARS KHAZAR Industrial Company show that total quality management is very dangerous for issues such as surplus sales size and is harmful to its efficiency and implementation, and this is only part of the inability of total quality management in PARS KHAZAR Industrial Company.

In general, today, total quality management in PARS KHAZAR Industrial Company has become a specialized strategy and the understanding of the concepts and principles of total quality management as one of the most important results of its comprehensive implementation has expanded. The researcher believes that TQM, in its current state and structure, alone is not able to understand future changes and the company should spend enough time to fully

establish a comprehensive quality management system. Some academic researchers believe that the learning organization is the next logical step in assessing the benefits of change because of its interdependence. Therefore, it can be said that in PARS KHAZAR Industrial Company, total quality management is an attitude according to which the company's management with the participation of all employees, customers and suppliers, continuously improves the quality to achieve customer satisfaction. Now, in order to be able to address the main challenges of total quality management in PARS KHAZAR Industrial Company, we examine its most important dimensions and main components as follows.

3-3-1 Leadership

Leaders determine the integrity of a company's goals and direction. They must organize the internal environment of the company in such a way that people work with full commitment to achieve the company's goals, and this is one of the main challenges in PARS KHAZAR Industrial Company. Low levels of productivity, inefficient use of resources and low levels of quality can be examples of poor management. Leadership for quality can be defined as leadership from the perspective of total quality management. Senior management teams in PARS KHAZAR industry company should be clear in presupposition and in their ability to equilibrate between process management and innovation management in order to achieve competitive advantage. The one of most crucial problem about leadership factor in TQM at PARS KHAZAR industry company can be seen in the inconsistencies in communication between different levels of the company.

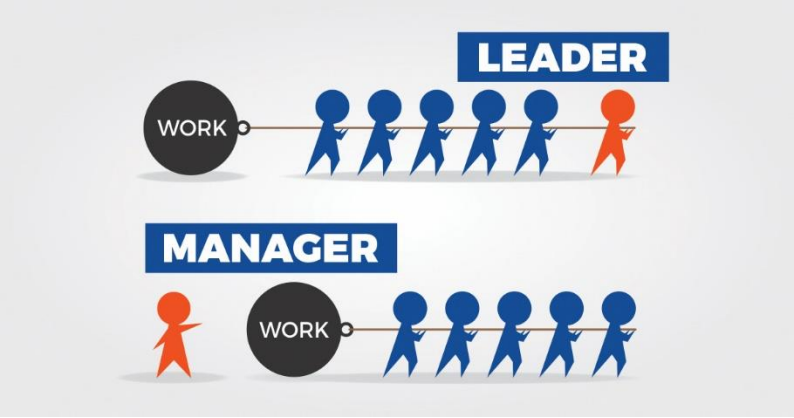

Figure3-1: The Difference between Leader and Manager.

The whole process of total quality management in PARS KHAZAR Industrial Company from the beginning, like any other unit in this company, including marketing and finance, is a dynamic part of the company that needs constant focus after the leadership of the

management. Therefore, the successful implementation and management of a comprehensive quality management system encompasses a wide range of issues and problems that need to be addressed on an ongoing basis. The leadership role of PARS KHAZAR Industrial Company in TQM Defines a flexible quality strategy based on the needs of stakeholders and customers and in accordance with the company's business goals that can be used in any production unit of PARS KHAZAR Industrial Company. After defining this strategy, it should be expanded as a driving force in the company and it should be disseminated at all levels in order to be effective in the optimal implementation of total quality management in PARS KHAZAR Company. Inclusive quality management strategy at PARS KHAZAR Industrial Company, has been developed to improve strategies to solve existing problems and how to provide improvement proposals, includes some models of delegating authority to employees, which are usually implemented individually or as a team. Leading an industrial company like PARS KHAZAR seems to be a complex responsibility that requires special and unique skills. The managers of this company are obliged to use their potential skills to find ways to cover their weaknesses and improve their behavior. Therefore, without continuous improvement, the company's capabilities are severely limited. In other words, if the managers of PARS KHAZAR Industrial Company do not continuously improve in their managerial responsibilities, it will cause energy loss and consumption by employees outside the organization. Therefore, the responsible leaders in PARS KHAZAR Company must be constantly vigilant and work on their personal competency for progress.

3-3-2 Knowledge and Process Management

According to engineering views at PARS KHAZAR Industrial Company, knowledge management is an organizational issue that seeks to control the capacities and experiences and spiritual and invisible skills of employees. Today, some senior executives at PARS KHAZAR Industrial Company believe that the knowledge management approach has been replaced by TQM as a tool for measuring the quality approach. The philosophy of knowledge and process management is just like complete quality management, continuous improvement. In fact, TQM is based on the Kaizen concept, which includes continuous analysis of organizational processes to ensure continuous performance and quality improvement at PARS KHAZAR Industrial Company and can be considered as a comprehensive organizational philosophy that continuous improvement throughout Promotes and develops the company. The basic features

of knowledge and process management approach in total quality management of PARS KHAZAR Industrial Company are as follows:

1. Avoid mistakes before making mistakes.
2. The importance of total quality management in the design of products, services and systems.
3. Identify the importance of customers to the company.
4. Public participation in improving the quality of the company's products.
5. Consider any company activity as a process that can be improved.

In general, moving from a traditional resource-based economy to a knowledge-based economy, its elements have become one of the core assets of industrial companies, including PARS KHAZAR, and their management seems absolutely essential. Knowledge management is the process of creating and sharing, transferring and retaining knowledge in a way that can be used effectively in the company. Today, the success of industrial companies, including PARS KHAZAR in the economic field, is due to their ability to acquire, encrypt and transfer knowledge in a more efficient way than competitors. Knowledge and process management include human behaviors, attitudes, and abilities, business philosophies, patterns, operations, procedures, and technologies. Because management processes (such as business process reengineering, organizational learning, and TQM) are constantly evolving, PARS KHAZAR executives often have difficulty adopting these procedures in the company. This part of the research is described to help better understand the subject and integrate the two concepts, similarities and differences between knowledge management and TQM. One of the most important challenges in recent years in PARS KHAZAR Industrial Company has been what process or department should be responsible for knowledge management in this company? From the perspective of PARS KHAZAR senior executives, the ideal is to manage knowledge management under an independent unit that operates directly under the highest management level of the company. Having several specialists related to this field, audio-visual facilities, educational space, etc., all make the staff of this unit perform in the best way with a relaxed mind and without worrying about doing other tasks and affairs; But the bottom line is that most senior executives are opposed to create an independent unit called knowledge and process management, and they also give reasons for the decision that are sometimes a Some of the reasons in this regard are as follows:

1. Lack of specialized manpower related to the subject of knowledge and process management in PARS KHAZAR.

2. Uncertainty about the effective performance of knowledge and process management in relation to its power supply.
3. Withdrawal of other employees from knowledge management responsibilities due to the existence of an independent knowledge and process management unit in PARS KHAZAR Company.

3-3-3 Customer Focus

The main focus of quality management in PARS KHAZAR Industrial Company is to meet customer needs and strive to exceed customer expectations. The final success of a company is achieved when it can gain and maintain the trust of customers and other shareholders. Any interaction with the customer is an opportunity to create more value for the customer. Understanding the current and future needs of customers and other stakeholders will help the company achieve sustainable success. In addition, the customer should be the main priority of organizations and also its survival depends on the customer. For companies such as PARS KHAZAR, which, despite a full understanding of the customer-oriented culture, the company's executive system works against this view and try to bridge the gap between customer perception and the company's executive affairs it is necessary to Be interpreted to turn from a repetitive and useless strategy into a tangible, believable and executive strategy. Leading industrial companies recognize that believing in a customer-oriented perspective is only part of a larger strategy that has a broad underpinning. The managers of PARS KHAZAR Company emphasize the fact that the existing obstacles to the implementation of customer-oriented culture have nothing to do with the customer and are mostly caused by internal barriers. To solve the customer orientation problem in PARS KHAZAR Industrial Company, according to the principles of total quality management, a structure must be created that can determine the necessary conditions for the implementation of customer orientation in this company. To do this and create coordination, consensus and mobility, it is necessary to provide this structure to all parts of the company. But to ensure the correct performance of the company in this field, there must be a criterion for using it to measure the success of PARS KHAZAR in implementing a customer-oriented culture. From the perspective of the managers of PARS KHAZAR Industrial Company regarding the existing problems to create a customer-oriented culture, the implementation of strategies related to the issue of total quality management has been done slowly. And this is one of the main challenges of the company under study. Problems such as:

1. Poor communication channels between executive teams, group managers and members of the sales and marketing team.

2. In-company administrative regulations that prevent communication, data sharing, and customer interaction records with other parts of the company.

3. Lack of empowerment of employees in decisions that improve the customer experience, the growth of customer-oriented culture and related strategies

Therefore, it is quite clear that the usual challenges in PARS KHAZAR Industrial Company are mainly related to organizational barriers and not to lack of customer understanding. Interestingly, most industrial jobs are initially created to meet customer needs and provide customer service. By creating a simple process, these companies gradually learn and improve the process of meeting customer needs, and thus, the customer experience also grows and improves. But with the growth of the company, the development of different teams and the creation of different parts of this issue becomes a major challenge, and during the time, system becomes more complex and this complexity eventually turns a major weakness for participants. This shift in focus to internal development quickly becomes an organizational epidemic, affecting all parts of the company, including management systems, sales, and marketing, human resources, and after-sales service. In short, shifting the focus and meeting customer needs to internal development decreases the number of customers and weakens the customer-oriented culture. In such circumstances, measuring customer satisfaction indicators for managers of PARS KHAZAR Industrial Company creates awareness about behavioral, belief and functional differences in the customer-oriented group and gives managers a comprehensive view of the performance of all teams in this field. They provide customer satisfaction and act as a catalyst to guide them toward the customer.

Figure3-2: Identify Customer Needs.

3-3-4 Strategic Planning

Optimal work strategy is the most important factor in implementing the vision, mission and goals of PARS KHAZAR Industrial Company. A suitable strategy should be both a daily activity and a long-term activity and should also be defined in the culture of the organization. If a company wants to survive and thrive in a global competitive market, it must adopt an effective strategy that gives it a sustainable competitive advantage. (Quality Management for Organizational Excellence: An Introduction to Overall Quality David L. Goetsch Stanley Davis, 7th, 2014) The relationship between strategic planning and total quality management at PARS KHAZAR Industrial requires management support and a commitment to change. In examining the relationship between total quality management and strategic management and especially strategic planning in PARS KHAZAR Industrial Company, the following five factors should be considered:

3-3-4-1 Implicit view of the Company

In terms of TQM and strategic planning, there is a significant difference among the company's perspectives. Strategic planning is the backbone of strategic management, which includes strategic planning and implementation, while expecting good results from strategic planning and TQM. Achieving the desired situation to predict the performance of PARS KHAZAR Industrial Company requires reasonable capacity to succeed in the future. The company's overall quality management focuses on meeting customer expectations, while strategic planning focuses strongly on the organization's mission and instead operates within the scope of its core mission.

3-3-4-2 Initial Orientation

While both strategic planning and total quality management at PARS KHAZAR Industrial Company have a forward-looking approach, strategic planning places more emphasis on the long-term horizon. Total quality management emphasizes quality assurance and customer satisfaction needs. In fact, the strategic prerequisites for achieving the best philosophies will be related to other operations to achieve the company's goals. Both total quality management and strategic management require considerable time to bring about organizational change, and this creates a lot of complexities in PARS KHAZAR Industrial Company because the company's leadership process is constantly changing.

3-3-4-3 Impact on Organizational Culture

Both strategic planning and total quality management require a profound change in the organizational culture of PARS KHAZAR Industrial Company. Especially in recent years, revised thinking and values are essential for change the culture for the implementation of total quality management and strategic management. TQM also emphasizes team building, quality, customer satisfaction and continuous improvement. While "the superior value of strategic management is maintaining the capacity of the organization in choosing options."

3-3-4-4 Leadership Requirements

In any organizational change, leadership support is critical to the success of strategic management and TQM. Organizational leadership at PARS KHAZAR Industrial Company is important in the development of organizational mission. Therefore, PARS KHAZAR senior executives understand what activities play an important role for their organizational success. Strategic management and TQM emphasize leadership from both ends of the spectrum. In PARS KHAZAR Industrial Company with strategic management, the main responsibility belongs to senior managers, while in TQM, leadership is an important part of any job and employees participate irregularly in redesigning work processes. and therefore, significant training for Employee participation is necessary with full cooperation in total quality management.

3-3-4-5 Emphasis on Management Control

Management control refers to where there is the greatest similarity between strategic management and TQM. Strategic management emphasizes internal needs and total quality management emphasizes factors such as controlling statistical processes to ensure continuous improvement. It is important for the managers of PARS KHAZAR Industrial Company to be able to influence the quality and quantity of the measured items. However, managerial control is one of the weaknesses of TQM and strategic management in PARS KHAZAR. Due to the difficulty of implementing management control mechanisms, quantitative management control is performed by understanding the integrity of controls, and measurements are constantly dependent on customer surveys and focus groups.

3-3-4-6 Creating a Relationship between Strategic Planning and TQM

The link between strategic planning and total quality management at PARS KHAZAR Industrial requires management support and a commitment to change. A strategic plan can be a blueprint for a company's strategic directions, including compliance with TQM.

3-3-5 Supplier Quality Management

In the PARS KHAZAR industry company, Lack of good supplier training has made problem. Due to inefficient supplier training, Supply chain management in PARS KHAZAR industry company face to the delay challenge and this company has issue to fulfill the specified demands in a good time manner. The supply chain management in TQM includes reducing and simplifying the supplier base to help supplier relationship management, establishing strategic alliances with suppliers, partnering with suppliers to meet requirements and mobilizing suppliers to use their know-how and experience in early product development. There are so many potential obstacles such as fluctuating availability of raw materials and procurement problems that can impact supply chain to bring about delays .Total quality management in PARS KHAZAR Company requires that in order for the company system to be fully efficient, each of its parts and components must work in coordination with other components and parts, because each person and each activity affects other people and activities. Good quality management for a great supplier facilitates a constructive and long-term relationship with suppliers and allows them to participate in product design and production processes in order to improve the quality of their goods or services (Singh et al., 2018). In this section, the researcher wants to examine the role of supply chain management in total quality management functions in PARS KHAZAR Industrial Company. How to manage the organization is to update the processes in order to adapt to the new needs of consumers, manage the organization's resources, provide the appropriate infrastructure and raw materials and increase their efficiency and create added value for the organization's employees, suppliers and the community. On the other hand, changing and complex environmental factors, including economic, political and regional conditions, challenge the company whether it has a good understanding of the level of quality expected. And with the current conditions, is there a guarantee for the survival of the company in the field of industrial production?

In recent years, PARS KHAZAR Industrial Company has introduced and developed a concept called "supply chain quality management" and it is referred to as the last step towards moving towards "total quality management" through which the company is able to will be able to integrate relevant concepts effectively and efficiently. The two management philosophies of "Total Quality Management (TQM)" and "Supply Chain Management (SCM)" and creating "synergy" and having three competitive factors (quality, price, delivery), supply chain

performance and increase the quality of final products to customers Data and thus creates a competitive advantage.

To achieve this goal in PARS KHAZAR Industrial Company, prioritizing and presenting a causal model of the main components of total quality management at the supply chain level can be the first step in implementing supply chain quality management in this company. Because as long as the supply chain members, as the executor, do not agree on these factors and there is a gap in their knowledge and understanding of how to implement it, the failure of such projects seems inevitable and this can be One of the main problems for PARS KHAZAR Industrial Company.

TQM's approach at PARS KHAZAR Industrial is to develop and apply a shared culture that emphasizes customer orientation, continuous improvement, workforce empowerment, and information-based decision making. Product design orientation based on customer needs and focus on product quality in all stages as the main factors in increasing product quality and as a result better performance of PARS KHAZAR Industrial Company.

Also, in the SCM working method in PARS KHAZAR Industrial Company, the decision-making process is designed in such a way that the interests of the buyer and the supplier are seen together and the goal is to optimize the circulation of materials in the supply chain. From the perspective of company managers in efficient supply chain management, the main factors are: reducing transfer time and material costs, as well as increasing product quality and responsiveness, which are also addressed in this study.

Based on SCM's view of PARS KHAZAR support, the focus is on coordinating factory support activities in the value chain. Removing materials from the supply chain in response to a demand pattern, rather than including them in the supply chain in response to forecasts, allows the company to respond effectively to unknown demands and simplify flows. Accelerate the supply chain, better implement warehousing management and improve service levels. This is synonymous with the concept of integrated support systems. The focus of supply is synonymous with the simplification and rationalization of supply principles and leads to the integration of suppliers to develop product and production activities. Supply chain management at PARS KHAZAR Industrial Company shows the reduction and smoothing of suppliers in order to facilitate communication between them and increase the alliance between them in a way that meets the company's expectations.

3-3-6 Human Resource Management

Human resource management is a specialty that plans and strives to satisfy employees and achieve organizational goals. In other words, it is responsible for the optimal use of employees in an organization. This responsibility includes identifying, selecting, hiring, and educating human resources in order to achieve the desired goals of the organization.

In today's competitive world, HRM and TQM are designed for resource efficiency and effectiveness. The main problem of today's managers is the organization and management of human resources in which there is the ability of the organization to develop, maintain and improve for better performance. Practical application of HRM in PARS KHAZAR Industrial Company including personnel recruitment, human resource development, performance compensation, employee participation and human resource team building in the organization to facilitate the implementation of TQM tools and techniques to commit performance systems, standards, policies, evaluation and reconstruction Continuous improvement. Therefore, interaction, coordination and regulation between these two systems can be effective in fostering a creative environment to improve productivity and effectiveness in better organizational performance and employee satisfaction. Human resources in PARS KHAZAR Industrial Company have shown different roles as facilitators in the case study of the human resources process in relation to the various stages of the development of total quality management, including internal procurement, covert incentives and facilitators.

The different roles of the human resource management process in PARS KHAZAR Industrial Company have been a great help in formulating and implementing human resource policies, quality policies, communication concepts and TQM creativity. Supporting the development of management in the quality of work of operational groups, forming quality training workshops, setting appropriate quality policies, systems, methods, changing organizational culture and staff, organizing TQM training programs in the organization. The HR process facilitates communication between the team and the team between units, just as it facilitates the TQM process in the organization. In PARS KHAZAR Industrial Company, the creation of quality policies of the organization is regulated with the participation of the human resources unit and the human resources manager can act as an internal consultant in other units to increase the development of total quality management. Improving TQM has created a set of logical challenges through human resource management, including: motivating students, satisfying employees, removing communication barriers, and solving problems that the organization faces in its development. Also, the human resources strategies in PARS KHAZAR Industrial

Company should be adjusted in accordance with the strategies of the organization. Accordingly, human resource management strategies should be developed in relation to the overall strategies of the organization. Total quality management in PARS KHAZAR Industrial Company can be successfully implemented through human resource management by planning, hiring, training and improving the proper use of quality engineering tools and related standards along with changing the culture of all employees. Human resources are one of the key assets of any company and play a vital role in quality and income growth (Aquilani, Silvestri, Ruggieri, & Gatti, 2017; Ebrahimi & Rad, 2017). Humans resources are a critical factor for building TQM which includes a variety of organizational development practices such as effective training, recruiting, procedures for health and safety, involvement, encouragement, appreciation, teamwork, etc. In reality, the organizational performance is improved by well trained, happy and dedicated people (Singh et al., 2018). Omar et al. (2018), Pradhan (2017), Mehralian et al. (2017), and Farish et al. (2017) suggested that the emphasis on human resources was strongly and positively associated with the success of organizations.

3-4 Conditions and Challenges of Green Innovation in PARS KHAZAR Company

As concerns about environmental degradation increase, strategies such as the use of clean technology and green innovation to protect and prevent environmental degradation have emerged at PARS KHAZAR Industrial Company today. Green technology selection is a process that the company uses as an effective element in planning and decision-making to achieve environmentally friendly products and processes. Completing this process is the use of green innovation at all levels in the company with the aim of developing the quality of the environment. Given that today the performance of PARS KHAZAR Industrial Company has been taken on a new concept and has been affected by various environmental aspects, so the company must adopt strategies to improve its environmental performance.

The modern world today has increased pollution and environmental problems, and as a result, governments and industrial organizations have become more concerned about the environment. These concerns led to the creation of a new concept called green innovation. With increasing environmental concerns from consumers, governments and communities around the world, manufacturing companies such as PARS KHAZAR Industrial Company are seeking to develop environmentally friendly programs such as green product development,

green branding, technology and green innovation. Using existing theories in the field of innovation management, organizational social responsibility, management styles, practical experiences and new insights are presented in this research. One of the main goals of the researcher in this study was to help the managers and senior experts of PARS KHAZAR Industrial Company to understand what green innovation is and how it can be implemented in this company. In addition, the role of big data, top management commitment, and human resource management practices to overcome technological challenges, achieve competitive advantage, and enhance economic and environmental performance must be considered. Therefore, the researcher deals with the relationships between green innovation, drivers and also the factors affecting technology challenges and the impact on the performance and competitive advantage of PARS KHAZAR Industrial Company. The role of TQM in explaining green industrial policies in order to achieve the economic and environmental benefits of the company is also examined. Therefore, in this research, an attempt has been made to identify the main elements of such a policy. First, it shows that greening the economy is not just about expanding a few green sectors. All sectors must play a role in achieving economics and reducing carbon and finding opportunities for higher resource efficiency and low carbon innovation throughout the industrial economy.

Second, this study presents a set of key features during which the general recommendation is that PARS KHAZAR Industrial Company is committed to a green innovation and industrial policy that is in line with the goals of reducing carbon in the environment and the broad aspirations of the green economy.

The present study examines the fundamental challenge of whether TQM reinforces green innovation or plays a deterrent role in its direction. In general, innovation in PARS KHAZAR Industrial Company includes any new action in the fields of equipment, products, processes, policies and projects. Technical innovation is related to products, services and production technologies. According to the academic literature, green innovations are a subset of public innovations and share many characteristics with them. The main question is what factors should or should play the role of PARS KHAZAR Industrial Company according to the role of environmental regulations in environmental innovation? And this is one of the most important challenges facing PARS KHAZAR Industrial Company. Today, the interest in identifying and measuring the environmental impact of various occupations has led to an increase in the interest of information system researchers and business activists in green technologies. Therefore, the use of green technologies in industry faces various opportunities

and challenges. These opportunities and challenges can lead to more competitive advantage than other competitors, and also the lack of such systems disrupts the activities of industrial companies such as PARS KHAZAR. Therefore, taking advantage of these opportunities and providing solutions to the challenges of using green technologies in this company is of great importance.

The biggest problem that PARS KHAZAR Industrial Company is facing today is the issue of change, and the acceptance of this fundamental change by this company will definitely be one of the biggest factors for its survival. From a professional point of view, industrial companies do not operate alone but are constantly competing with each other. In this dynamic and competitive market, innovation and thus creating a competitive advantage ensures the survival of any company. Because today the environmental performance of PARS KHAZAR Industrial Company and compliance with environmental regulations is considered as a competitive advantage for it, the compatibility of any innovation with environmental considerations is very important. Given this necessity, the concept of green innovation by promoting environmental productivity, guarantees the company's competitive advantage in domestic and global markets.

Siva et al. (2016) and Chi et al. (2010) classified green innovation into two categories: green technology innovation (GTI) and green management innovation (GMI). In particular, green innovation can be seen as hardware or software innovation and can be related to green products (Chen et al., 2006). These include innovations in technologies that are involved in energy saving management, pollution prevention, waste recycling, green product "design" and finally the company's environmental management (Lane et al., 2014). Thus, Chen et al. (2006) classified green innovation into three categories: green product innovation, green process innovation, and finally green management innovation. In general, the goal of green innovation is to reduce the adverse environmental effects, and this important factor is considered throughout the value chain from supplier to consumer. Previous researchers have identified green innovation in four main dimensions:

- ✓ Green Product Innovation
- ✓ Green Process Innovation
- ✓ Green Technology Innovation
- ✓ Green Management Innovation

3-4-1 Green Product Innovation

Green product innovation is the creation of new products that incorporate environmental aspects into their life cycle. Including raw materials, their production processes, transportation and their use in a way that has the least impact on the environment (Pemayun and Suprapti, 2016) recent studies have shown that green products are in greater demand and therefore can increase company revenue (Dewi et al., 2019). Innovation in the green product created by companies is also expected to minimize resource utilization and increase efficiency in allocating operating costs. Green crop practices include crop characteristics that reduce environmental impacts throughout the life cycle, such as reducing weight and crop size (Zhu et al, 2012), increasing energy efficiency (Eltayeb et al., 2011), The use of non-polluting materials (Altaib et al., 2011), specifications of modular components that are easily degradable, recyclable and reusable (Zhu et al, 2012) and specifications of intelligent and reversible packaging (Adlmaier and Sellitto, 2007).

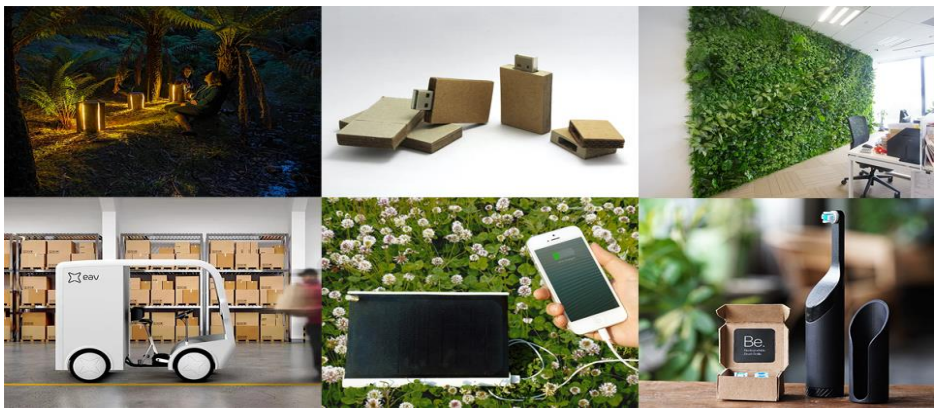

Figure 3-3: Green Product Innovation.

3-4-2 Green Process Innovation

Green process innovation involves corporate activities with respect to energy and resource savings used (Chen et al., 2012). These savings are expected to minimize operating costs and increase corporate profits. This increase in profit can automatically improve the company's performance. Green process methods include process characteristics that reduce environmental impacts over the life cycle, such as lean manufacturing (Lee et al., 2013), agile production (Azohdo et al., 2011) and quality control methods that produce weak components, and Reduces poor quality.

Figure 3-4: Green Process Innovation.

3-4-3 Green Technology Innovation

Green technology is a universal term that refers to any type of technology that has an environmentally friendly production process. A technology that reduces or reverses environmental damage. Or even a process of producing clean energy, such as solar energy. The goal of green technology is sustainability, environmental protection and even repairing past damage. These new methods include recycling, renewable energy sources or LED lighting. There are also different types of green technology that we are currently using, but as we see the effects of global warming increase, humans need to do more.

(https://www.bioenergyconsult.com/) GTI aims to integrate environmental knowledge with technology. Through the GTI, companies introduce or improve existing products or existing processes that save raw materials, energy, and resources and harmonize the environment, economy, and production processes (Fernando et al., 2019). Environmental technologies should be installed and operated in the entire supply chain of modern equipment with less energy requirements and reduction of CO2 emissions (Jabour et al., 2017) as well as reduction of scrap, waste, rework, stocks and residual materials They point out. (Sivakumar et al., 2015). Environmental technologies also include technological activities such as the use of software, mineral exploration, and modeling to improve the environmental performance of the production process (Luthra et al., 2014) and transportation routes (Colicchia et al., 2017).

Figure 3-5: Green Technology Innovation.

3-4-4 Green Management Innovation

At GMI, companies either restructure the existing management system or adopt a new system that allows them to improve management and production processes, thereby eliminating or reducing negative environmental impacts. Qi et al., 2010). Green management innovation refers to the adoption of new organizational structures or management systems and thus reduces additional production and management processes to minimize negative environmental impacts (Qiet al., 2010) One of the important examples of innovation in management, management systems Is a comprehensive and energy-saving environment (Qi et al., 2010; Damanpour and Aravind, 2012).

Figure 3-6: Green Management Innovation.

3-5 Conditions and Challenges of Sustainable Development of PARS KHAZAR Industrial Company

Sustainability is an increasingly important necessity for human activities and makes sustainable development a key goal in human development. At the core of the concept of sustainable development is the fundamental view that social, economic and environmental concerns must be addressed simultaneously and comprehensively in the development process. Technically, sustainability is an important and growing need for productive activities and creating sustainable progress is a key goal in human development. At PARS KHAZAR Industrial Company, sustainable development is a method that targets social, economic and environmental issues in general and simultaneously in the development process. In this company, sustainability is scattered in many fields, including engineering, designing and production, and the company is more and more involved in the issue of sustainability. In the research literature, while sustainable consumption targets consumers, sustainable production is related to the companies and organizations that produce or deliver products or services. This research also focuses on the development of trade sustainability in PARS KHAZAR Industrial Company and tries to introduce a new method for introducing, upgrading and measuring the company's production performance based on a set of main and complementary indicators of sustainable production and especially a thematic index by quality management. Offer comprehensive as well as green innovation. A review of the developments of total quality management in PARS KHAZAR industrial company shows that this company was established first to deal with severe environmental changes and improve total quality management on its organizational performance and then to gain more market share and competitive advantage.

The study of the relevant theoretical foundations shows that if the components and processes of total quality management of the company are not effective enough, the organizational consequences of green innovation and sustainable development of the company will be problematic. The present study shows that TQM has a positive effect on the process of green innovation, increases performance, customer satisfaction and reduces pessimism, thus the company achieves a competitive advantage and develops sustainability.

In this research, TQM is in fact a set of policies adopted by PARS KHAZAR Industrial Company regarding green innovation and sustainable development of the company. A set of actions to be taken in response to concerns about the natural environment and social issues

related to issues such as design, production, production, distribution, consumption, reuse and disposal of products and services, participation in planning and resource management, activities Preparation, conversion and purchase in the pre-production period, in the production and post-production stages, use in a closed loop period by sharing information about all stages of the product life cycle between different parts of the company with explicit consideration of social and biological consequences Plan and implement an environment to achieve a shared vision.

Establishment of a comprehensive quality management system in PARS KHAZAR Industrial Company by voluntarily integrating economic, environmental and social considerations with domestic business systems, for efficient and effective management of materials, information and main streams related to the purchase, production and distribution of products or services with The purpose of meeting the needs of stakeholders and increase profits and competitive advantage and sustainability of the company in the short and long term is planned and based on this research, indicators that have been selected and defined as different dimensions of sustainable development of PARS KHAZAR Industrial Company are:

3-5-1 Economic Indicators

Microeconomic factors such as cost, profitability and revenue and macroeconomic indicators such as profit, GDP, labor productivity, market concentration and dependence on imports or macroeconomic growth are important problems of PARS KHAZAR Industrial Company in this field.

3-5-2 Environmental Indicators

Factors related to system input such as renewable energy sources, water and energy consumption or water quality. Factors related to environmental outcomes such as waste and pollution. In addition, ecological factors can be affected. Also, the construction environment, current activities and technical and equipment failures in PARS KHAZAR industrial company can be added to this section.

3-5-3 Social Indicators

These indicators are mostly related to internal factors of the company such as wages, gender ratio of employees as well as external influential factors such as the needs and wants of specific customers, social acceptance and cooperation with employers or growth. They also

belong to a population of the community that is considered as the social challenges of PARS KHAZAR Industrial Company in developing its sustainability.

In recent years, environmental pollution has become a challenging issue for PARS KHAZAR Industrial Company and has led to increased demand from customers and environmental communities for environmentally friendly products. In addition, PARS KHAZAR Industrial Company must develop strategies to reduce the impact of its products on the environment and society in order to comply with environmental regulations for the sale and export of products. Therefore, the important challenge of PARS KHAZAR Industrial Company in the present century is the integration of environmental, economic and social functions of the company in achieving sustainable development. Therefore, in this research, the researcher tries to integrate the sustainable development of the company with economic, environmental and social needs in all stages of product design, selection and supply by accurately establishing a comprehensive quality management system and by playing the role of green innovation as a mediating variable. Plan and execute raw materials, production, distribution and transfer processes, customer delivery, and recycling and reuse management to maximize energy and resource efficiency while improving overall company performance**.** Rising concerns about environmental warnings are forcing PARS KHAZAR Industrial Company trying to implement environmental management solutions. In this regard, adverse environmental effects occur at all stages of the product life cycle and since Management of environmental programs and operations is not limited to the company's borders, understanding of environmental responsibility, PARS KHAZAR Industrial Company leads to competitive advantage and thus increase market share through the process of improving the environmental impact of the company's products.

The environmental management of PARS KHAZAR Industrial Company is an effort to minimize the negative environmental impact of the company's products during the product life cycle. This action is necessary due to organizational pressures and increases the efficiency of resources used in the company's environmental management. In recent years, the focus on environmental management has expanded from internal operations to the entire TQM system. The expansion of this method in all aspects of total quality management and green innovation has led to an increase in the efficiency and effectiveness of PARS KHAZAR Industrial Company.

The community and the environment are the stakeholders of the company and responding to them and ensuring the balanced interests of the shareholders is one of the important policies

of PARS KHAZAR Industrial Company. The company is also working to move within the framework of law, environment and society in order to achieve sustainable development with a pioneering approach and voluntary response to them. In this regard, PARS KHAZAR Industrial Company, as an organization responsible for environmental affairs, in addition to complying with legal requirements, has so far taken effective environmental measures by taking the following measures:

1. Conversion of fuel system of boilers and hot air furnaces from fuel oil to gas fuel in order to reduce environmental pollutants.
2. Convert all central heating house engines to gas burning mode.
3. Convert the heating system of all workshops to gas burning mode.
4. Changing the dyeing system from liquid dye method to powder dyeing method (electrostatic) which eliminates the toxic vapors emitted and a very significant reduction in the amount of fine dye that enters the ecosystem as waste, and allows the excess dye to be reversible in new mode.
5. Elimination of cyanide compounds in the plating unit.
6. Mechanization of wastewater treatment system, the effluent from the company is now standard in terms of environmental characteristics. The accuracy of this claim is confirmed by environmental inspectors through periodic sampling.
7. Obtaining the international certificate of environmental management system ISO-14001: 2015.
8. Prevention of device failure and control of the company's physical assets and waste of resources by creating a maintenance and repair planning unit (PM) since 1991.
9. The organization's approach to optimizing material inventories and reducing resource waste, using an integrated material management planning system.
10. Applying the method and forming teams of industrial beautification system (5S).
11. Establishment of Energy Management Committee in 1997 in order to optimize energy consumption.
12. Obtaining the certificate of optimal energy consumption management system (ISO 50000001-2011).
13. Separation of wastes and wastes in the organization with a suitable method for their recycling, such as: separation of plastics, foam, cartons, paper and… Separation of electronic and chemical components such as batteries.

3-6 The Importance of Sustainability in Industrial Companies

Sustainability in recent decades has generated considerable attention in production research and has become an important driver in the development of innovative technologies and management concepts. The system must be fully tied to the ongoing assessment of customer needs and depends on the flow of ideas on how to improve, reduce diversity and create greater customer satisfaction. There is also a need for a high level of commitment and a sense of personal responsibility in the people who run the processes. Another useful process improvement process that is often associated with IT / software implementation is: standardization; Simplify, shrink; Sharing and delivering a continuous improvement cycle ensures that the organization learns from the results, standardizes what it does well in a documented quality management system, and improves the performance and learning outcomes. But the main emphasis should be that this is done in a planned, systematic and conscientious way to create lifestyle conditions that permeate the entire organization. Due to declining natural resources and increasing global warming, companies have experienced significant pressure from society (Albort-Morant et al., 2018) as well as other stakeholders to abandon ways of creating environmental problems and adopt things that are about Ensure sustainable development (Davenport et al., 2018). According to Wijethilake (2017), sustainable development has three indicators, namely environmental, social and economic sustainability. Environmental sustainability emphasizes the environment and natural resources, social sustainability is related to society and people, and economic sustainability focuses on the economic and financial aspects of companies (Guerrero-Villegas et al., 2018). The concepts of sustainable development also relate to a modern, multidisciplinary approach called green theory, which states that companies should focus on adopting green management strategies and use modern technology to produce environmentally friendly products and services. In 1994, John Elkington coined the term Triple Bottom Line (TBL) for sustainable development (Elkington, 2018). Andrew (2011) concluded in his studies that the realization of the concept of sustainable development as a strategy to have a better environment has failed so far. In response to this view, the OECD (2011) is working on a new strategy defined as "green growth" that can be subdivided into it is considered to be the sustainable development of companies.

3-6-1 Sustainability Management System: The Triple Bottom Line

Sustainable development is known as 3P, the key elements of which are people, profit and the planet. The idea of a triple line (TBL) was defined by John Elkington in 1995, who three years later discussed in detail in his book what role each measure plays in sustainable development. TBL is a guide for companies. This helps them reduce the detrimental effects of their activities and, while looking to economic success, also encourages the creation of environmental and social values (Elkington, 1998). According to Robert Brown, with the introduction of TBL, the idea of increasing the value of the company has changed: in order for a business to be successful in the long run, in order to reduce the risks of maximizing short-term profits, Social and environmental considerations and must also be able to report the results in these areas" (Brown, 2015). The triple bottom line is one of the main systems used by companies to evaluate their profits through corporate sustainability solutions. The Triple Bottom Line method requires you to look beyond the traditional policy to the social, environmental and economic benefits to your business. And measure your business using the Triple Bottom Line, one of the best indicators of business viability and true profitability. Using the Triple Bottom Line method, your business can expand how it understands its position in the current economy and its ability to survive in the future. Company sustainability measures your company's ability to do business indefinitely based on the impact of your company's performance on the environment, your company's relationship with society, and your company's share of the economy. In fact, all three factors play a key role in determining whether your company can stay in business and make a profit. (https://www.era-en Environmental.com/) Using sustainability, TBL provides a framework for measuring business performance and corporate success using three lines: economic, social and environmental (Goel, 2010).

Figure 3-7: TBL Model.

A company's environmental behavior can have a significant impact on its position, brand value and financial results (Kádeková et al. 2020). The main goal of sustainable development is to achieve optimal interrelationships between economic, environmental, social and technological systems.

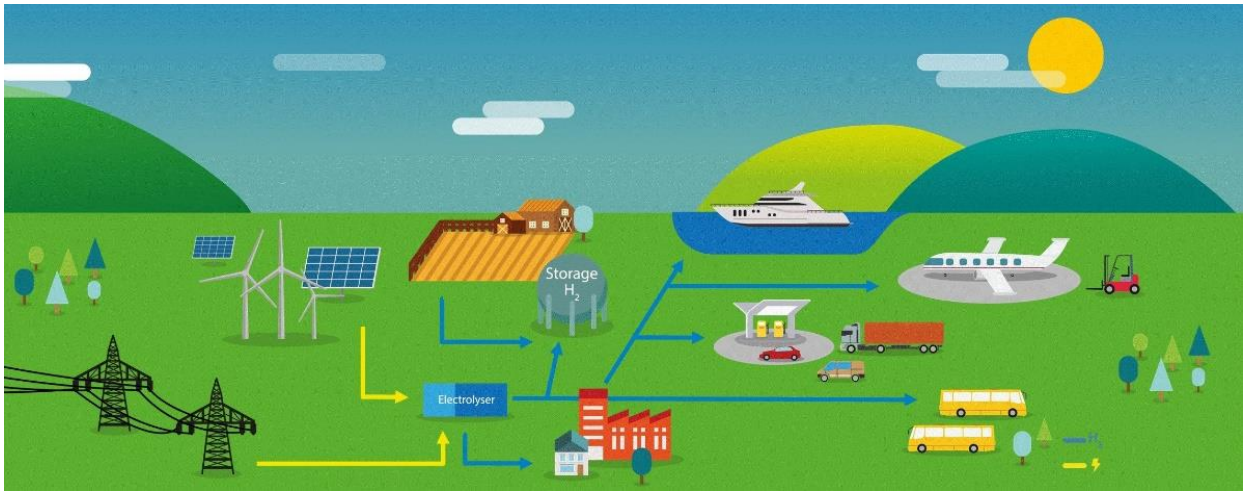

Figure 3-8: Environmental Focus.

3-6-2 The Relationship between Innovation and Sustainability

Innovation is the main option for economic growth and development of companies. The globalization of markets has created intense competitive pressures. Rapid advances in technology, rapidly evolving markets, and customers who are in high demand need to produce

new products with high quality, efficiency, and effectiveness. Innovation for sustainability is a broad concept related to the increasing development of new products and services, processes, technologies, organizational practices, business models, and even entire "systems". (Adams et al., 2016). This can be considered as a commercial introduction of products, services or combinations of products and services that, based on a traceable assessment, have environmental and social life cycle benefits over previous versions (Hansen and Grosse-Dunker, 2013).

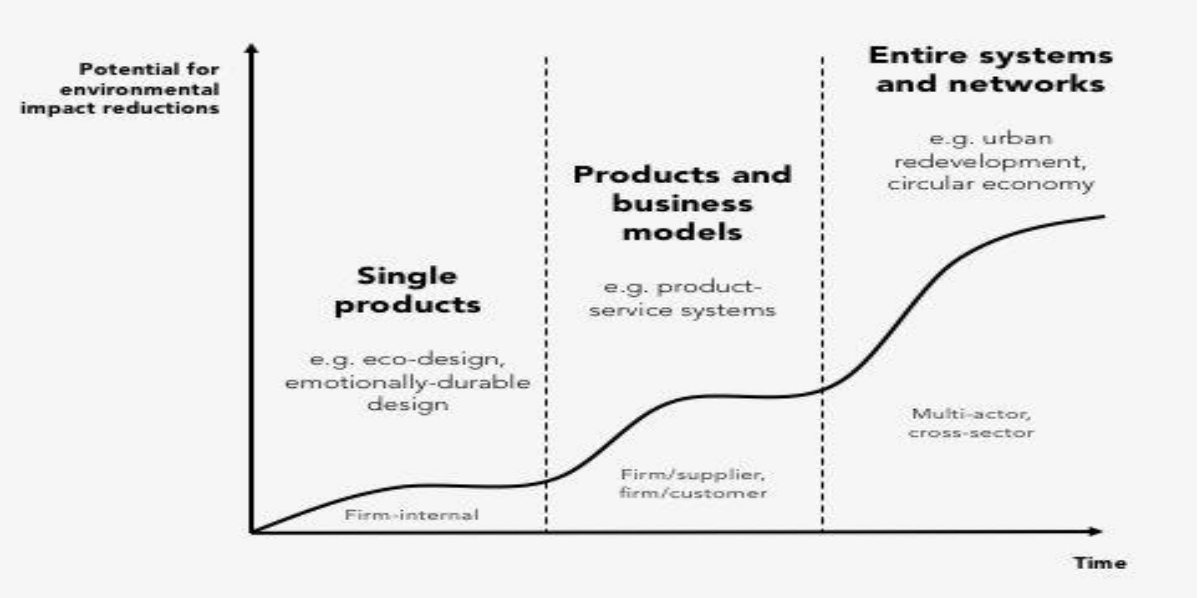

Figure 3-9: Innovation for sustainability spectrum.

Environmental concerns are constantly changing society's perceptions of activities that could harm ecosystems in the long run. As a result, companies need to develop strategies to implement innovations in order to minimize the negative impact of their operations on the environment. Green innovations refer to various innovations that can reduce the adverse effects on the environment to provide a great opportunity for companies to achieve the goals and benefits of environmental performance (Wong et al., 2013; Lin et al.., 2014). As a result of environmental concerns, the manufacturing industry has stepped up its efforts to implement green innovation to reduce energy, pollution, recycling, and ease of reuse of recycled materials (Dangelico, Pujari, & Pontrandolfo, 2017). The adoption and integration of green innovation has helped create more revenue opportunities and reduce environmental impact among multinational corporations such as Unilever, Ikea, Nike, Whole Foods and Tesla (Williams, 2015). Firms need strategies to manage environmental issues, win markets with

environmentally friendly products, and continue to work for the foreseeable future, and so the green innovation strategy is considered to be the most significant strategy in the age of environmental awareness. A green innovation strategy directs senior stakeholders, middle management, operations management, and internal stakeholders of companies toward the integration of organizational resources and employee behavior to reduce the risks of adverse effects of production processes and productivity on the environment. Therefore, this type of behavior strengthens organizational identity (Song and Yu, 2017). Organizations that have the ability to innovate green can use green resources and the ability to respond quickly and appropriately to customer needs to enjoy competitive advantage (Albort-Murant et al., 2018).

3-7 Conceptual Model of Research based on Literature and Research Background

In the final part of this chapter, the researcher evaluates the conceptual model of the research, which is taken from the thematic literature and research backgrounds related to the present research, to test the hypotheses proposed in PARS KHAZAR Industrial Company. In this model, three main variables are defined. Total quality management as an independent variable, corporate sustainability development as a dependent variable and green innovation as a mediating variable play a role in this model. The researcher tries to conduct field studies in the environment of PARS KHAZAR Industrial Company and by distributing a questionnaire among the managers of the research sample, the details which are complete both from the perspective of research methodology and from the perspective of data analysis in Chapter 4 of this dissertation will be presented, data and information required to review and test the three main hypotheses defined in the proposed research model and using appropriate statistical methods and related software, check their accuracy and validity he does.

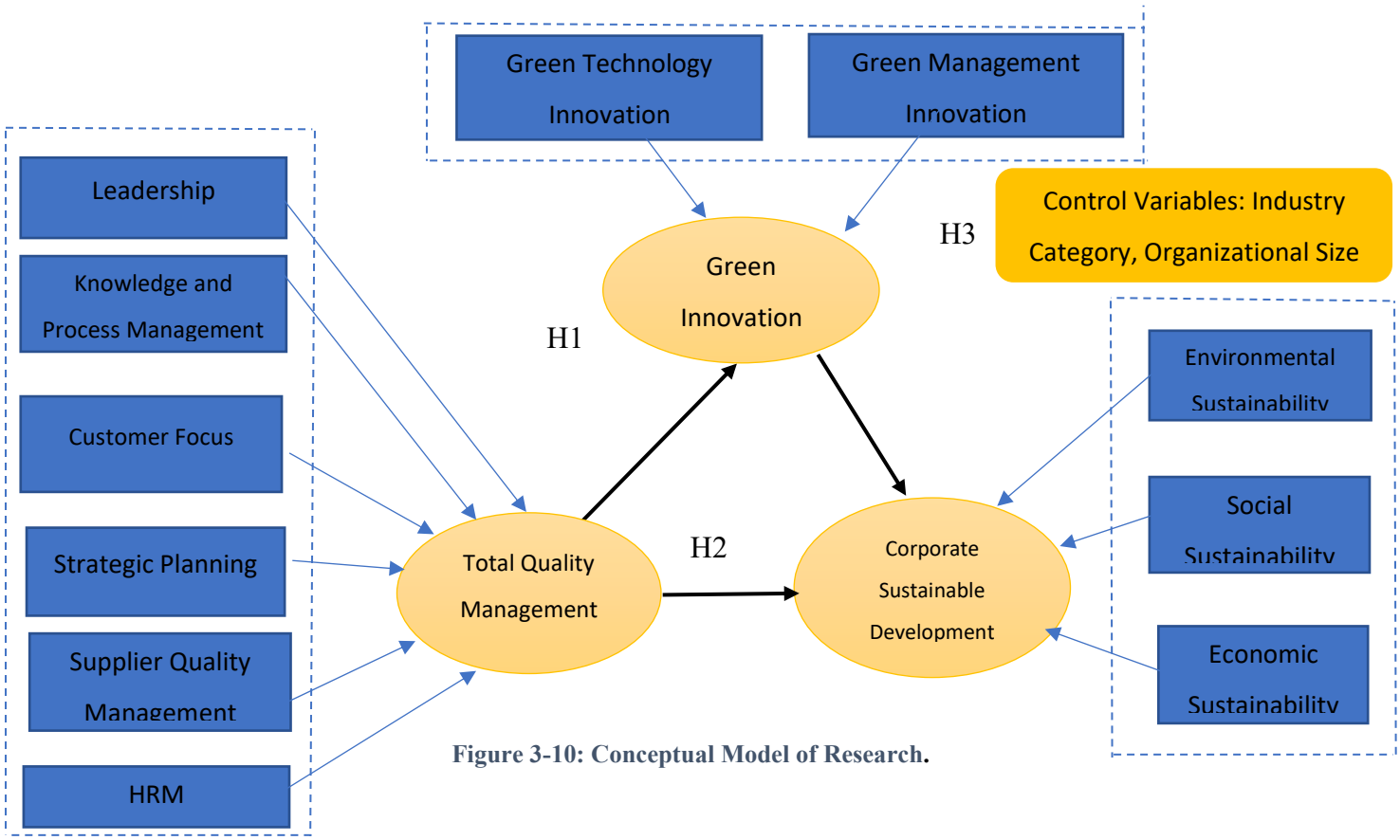

Figure 3-10: Conceptual Model of Research.

3-7 Chapter Summary

In this chapter, the researcher refers to the theoretical foundations of the main variables of the research, including total quality management, green innovation and development of company sustainability, as well as the components and structures of each of them in the form of a conceptual model based on thematic research records, conditions and challenges. The main of each of these concepts was reviewed in Pars Khazar Industrial Company.

Chapter 4: Research Methodology and Data Analysis

4-1 Introduction

The goal of all science is to know and understand the world around us. In order to be aware of the problems of the social world, scientific methods have undergone significant changes. These trends and movements have led to the use of scientific methods to study various human disciplines. One of the characteristics of a scientific study that aims to find the truth is the use of an appropriate research method and the choice of appropriate research method depends on the objectives, nature and subject matter of the research and implementation facilities. During the research process, using data collection tools, data is observed, reviewed and extracted objectively and validly, and then using descriptive and inferential analysis techniques, quantitatively and non-quantitatively, scientific claims and conjectures are tried. The first (hypotheses) are tested and finally the hypotheses are rejected or accepted and the final conclusion is made.

This chapter briefly describes the research methodology including the type of research method, statistical population, research sample size, research tool, validity and reliability of research tool, normal status of research data, type of statistical test and data analysis.

4-2 Research Method

Since this study examines the effect of the dimensions of total quality management on the sustainable development of PARS KHAZAR Company with emphasis on green innovation, so its research method is descriptive-correlation. Also, the results of this research can provide valuable information to managers and be used for their better performance, so this research is applied in terms of purpose. Also on the other hand because the data of this research using

tools a questionnaire that will be provided to the managers of the company's senior experts will be collected, so from this perspective, the present research is among the field research.

4-3 Statistical Population of the Research

The statistical population of this study includes 132 managers (Senior Managers, Middle Managers, and Operations Managers) of PARS KHAZAR Industrial Company in Rasht city located in Guilan province (northern Iran).

4-4 Sampling Method and Estimation of Research Sample Size

The Cochran limited community sampling formula was used to determine the sample size. Therefore, 98 managers include Senior Managers, Middle Managers, Operations Managers of PARS KHAZAR Industrial Company were selected as the statistical sample of the research.

N: community size, z equals 1.96, p = q = 0.5, d Allowable error value (error value)

n = (132 * (1.96) ^ 2 * 0.5 * .05) / (132 (0.05) ^ 2 + (1.96) ^ 2 * 0.5 * 0.5) = 98

4-5 Data Collection Tools

The data collection tool in the present study is a questionnaire with a 5-point Likert scale that is extracted from the reference article of Abbas and Sagsan (2019).

4-6 Validity and Reliability of Research Tools

4-6-1 Validity

In this research, content validity method has been used. Content validity ensures that the tool in question contains a sufficient number of appropriate questions to measure the concept under measurement. That is, content validity shows how accurately the dimensions and elements of a concept are covered (Sakaran, 2007).

4-6-2 Reliability

To measure reliability, we use an index called the "reliability coefficient" and its size usually varies between "zero tics". Spss25 software has calculated this amount.

4-7 Methods of Analyzing Research Data

Data analysis is a multi-step process in which the data provided through the use of collection tools in the statistical sample (community) are summarized, coded and categorized and finally processed to establish the types of analysis. Provides connections between these data to test hypotheses.

In fact, data analysis includes three main operations: first, description and preparation of data necessary to test hypotheses; then analyze the relationships between variables; finally, compare the observed results with the results that the hypotheses expected. In this process, data is refined both conceptually and empirically, and various statistical techniques play an important role in inferences and generalizations.

To analyze the collected data, analytical statistics are presented in both descriptive and inferential statistics. First, using descriptive statistics, a cognition of the status and demographic characteristics of the respondents is obtained, and then in the inferential statistics of this research, the hypotheses of the research are examined.After collecting the questionnaires from the statistical sample, their statistical analysis is performed using 25 SPSS and Smart PLS software.

4-8 Introduction of Statistical Software for Research Data Analysis

In this research, to investigate the research model, the structural equation method and the partial least squares (PLS) approach using Smart PLS software have been used. The PLS method is the best tool for research analysis where the relationships between variables are complex, sample size is small and data distribution is abnormal (Diamantopoulos et al., 2012). Consistent partial least squares (PLSc) path modeling is a variance-based structural equation modeling technique (Dijkstra and Henseler 2015; Henseler et al. 2016). This method allows the combined use of latent variables that show concepts that are based in theory and data from manifest variables. PLSc was applied to evaluate the measurement model (i.e., the reliability and validity of the measures) and to estimate the structural model (i.e., the modeled relationships between constructs). Use of PLSc was justified for the following reasons (Henseler et al. 2016): First, we used latent variables as composites. Second, the research model had reflective latent variables (Henseler 2017) that were used to define a state where

perceived variables were equally dependent upon another variable which was not itself observed.

In this research, for the PLS method, the two-step method proposed by Holland (1999) for data analysis has been used. In the first stage, the fit of the measurement model (external model) and in the second stage, the structural model fit (internal model) are examined.

PLS is a variance-based approach that requires fewer conditions than similar techniques to structural equations such as LISREL and AMOS. For example, PLS path modeling is more appropriate for real-world applications, especially when the models are more complex or the data distribution is abnormal. Of course, the main advantage of PLS modeling over LISREL is that it requires fewer samples. PLS also examines two models simultaneously, the external model (measurement model), which examines the relationship between explicit variables and hidden variables, and Internal model (structural model) that measures the relationship of hidden variables with other hidden variables.

The overall model includes each part of the measurement and structural model, and by confirming its fit, the overall fit of the model is checked. The general criterion presented in the PLS method for examining the overall fit of the model is presented by Tennhaus et al. (2005) and is the only existing criterion that is currently calculated as follows:

$$\mathrm{GoF} = \sqrt{\overline{\mathrm{Com}} \times \overline{R^2_{\mathrm{inner}}}}.$$

Which $\overline{\mathrm{com}}$ means the average of the common values of the latent variables of the model and also $\overline{\mathrm{R}^2}$ the mean of the coefficients for determining the latent variables of the research.

The reasons for using PLS in this research can be summarized in the following points according to the sample size(Cepeda-Carrion, G. et al., 2019):

1. This method is easier to use than other methods of structural equations
2. Lack of sensitivity of PLS to the sample size and the inevitability of the data reduces the researcher's concern.
3. In correlation and prediction research, the results of this method are not significantly different from covariance-based methods (first generation).
4. This method can be used both in low volume and in high sample volume.
5. This method can be used both in normal and abnormal distribution.
6. Existence of moderator variable (Methods of analysis of moderator variable depending on whether they are quantitative or qualitative.) If the modifier variable desired by the researcher

is qualitative, the group analysis method is used. But if the modifier variable is small, the method of making the interactive variable, which is described in the guide section of Smart PLS software, will be used.

4-9 Description of demographic variables

In this section, first, the demographic characteristics of the study population, including gender, education, work experience and organizational position of the respondents are examined and described. In the next section, using descriptive statistical methods, the independent and dependent variables of the research are described using parameters such as mean, standard deviation, variance, skewness, and the distribution diagram of the variables and their conformity with the normal distribution curve are displayed.

4-9-1 Description of respondents' gender

As can be seen in Table (4-1), the frequency percentage is male (75%) and the frequency percentage is female (25%).

Table 4-1: Frequency of Gender.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	24	24.5	24.5	24.5
	Male	74	75.5	75.5	100.0
	Total	98	100.0	100.0	

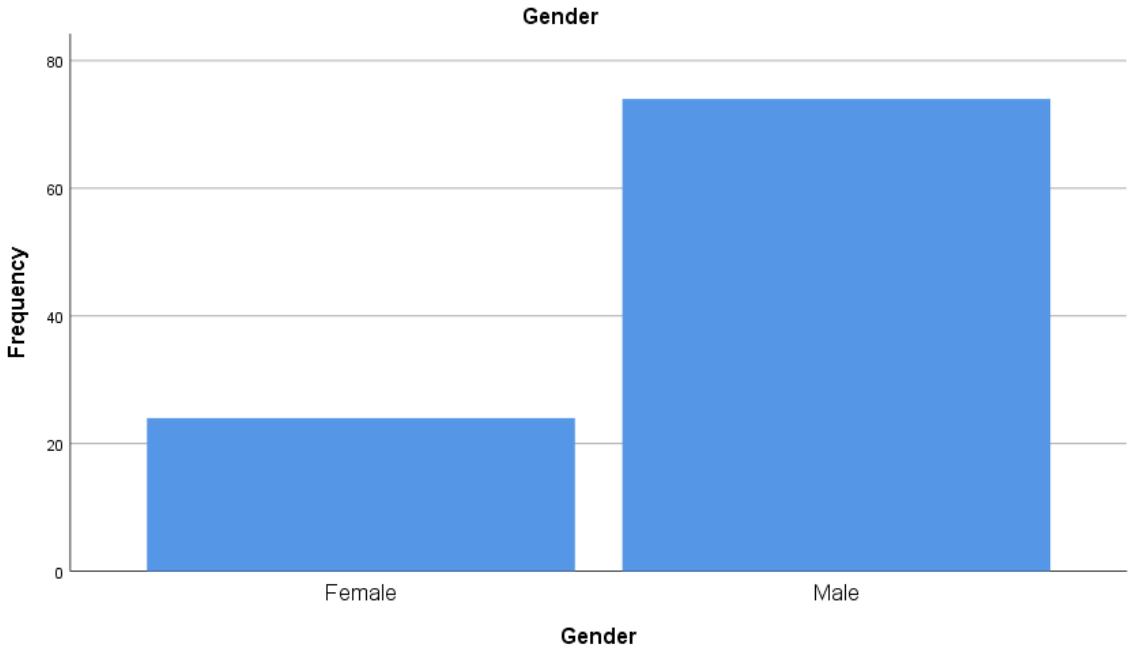

Figure 4-1: Histogram of Gender.

4-9-2 Description of respondents' education

As can be seen in Table (4-2), the highest frequency of education is related to bachelor's degree (57%) and the lowest frequency of education is related to doctoral education (6%).

Table 4-2: Frequency of Education.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor	56	57.1	57.1	57.1
	Masters	36	36.7	36.7	93.9
	PhD	6	6.1	6.1	100.0
	Total	98	100.0	100.0	

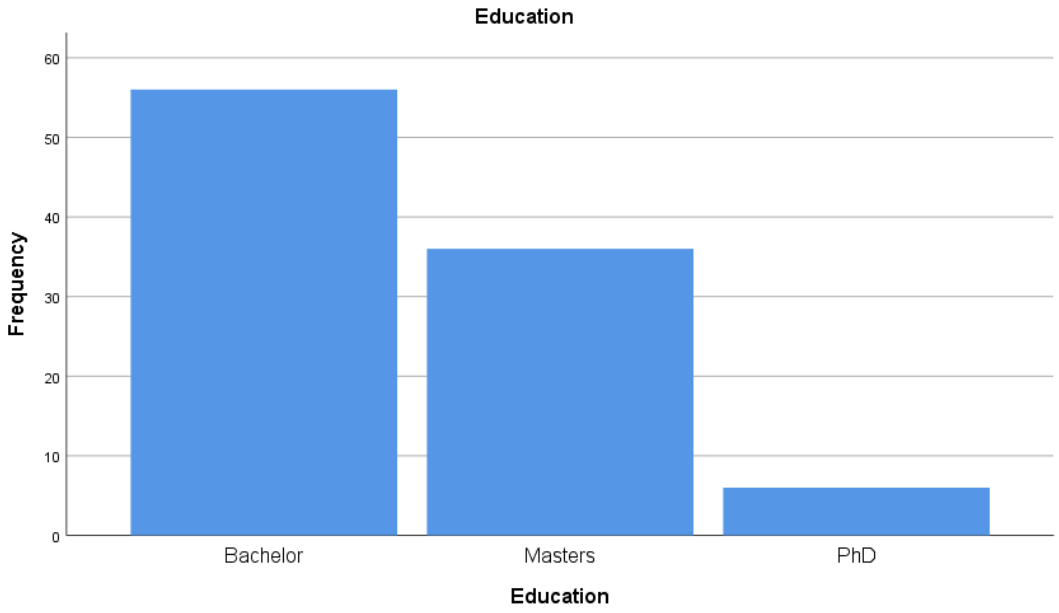

Figure 4-2: Histogram of Education.

4-9-3 Description of respondents' work experience

As can be seen in Table (4-3), the highest percentage of work experience belongs to the group of 11 to 15 years (33%) and the lowest percentage of work experience belongs to the group less than 5 years (18%).

Table 4-3: Frequency of Service History.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5 years	18	18.4	18.4	18.4
	6-10 years	26	26.5	26.5	44.9
	11-15 years	32	32.7	32.7	77.6
	more than 15 years	22	22.4	22.4	100.0
	Total	98	100.0	100.0	

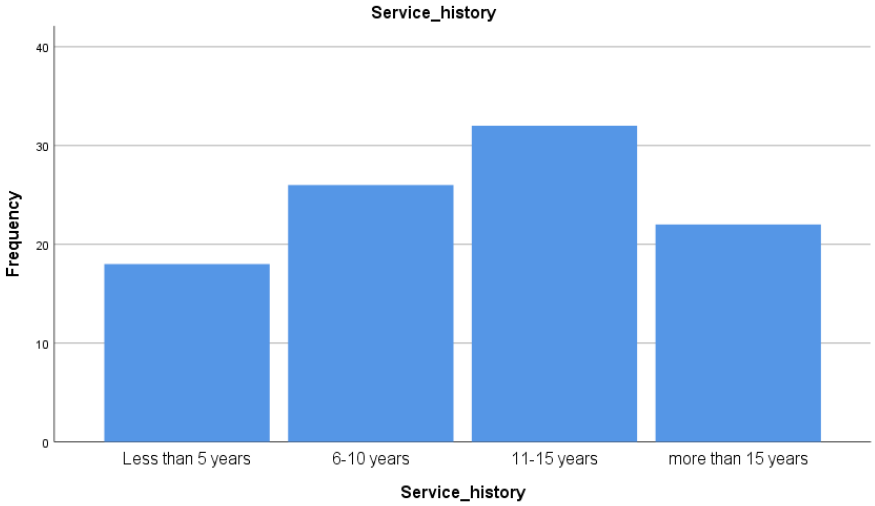

Figure 4-3: Histogram of Service History

4-9-4 Description of respondents' organizational position

According to Table (4-4), 52% of the respondents are related to operational management levels, 29% are middle managers and 19% are senior managers of the company.

Table 4-4: Frequency of Organizational Position.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Operations Manager	51	52.0	52.0	52.0
	Middle Manager	28	28.6	28.6	80.6
	Senior Manager	19	19.4	19.4	100.0
	Total	98	100.0	100.0	

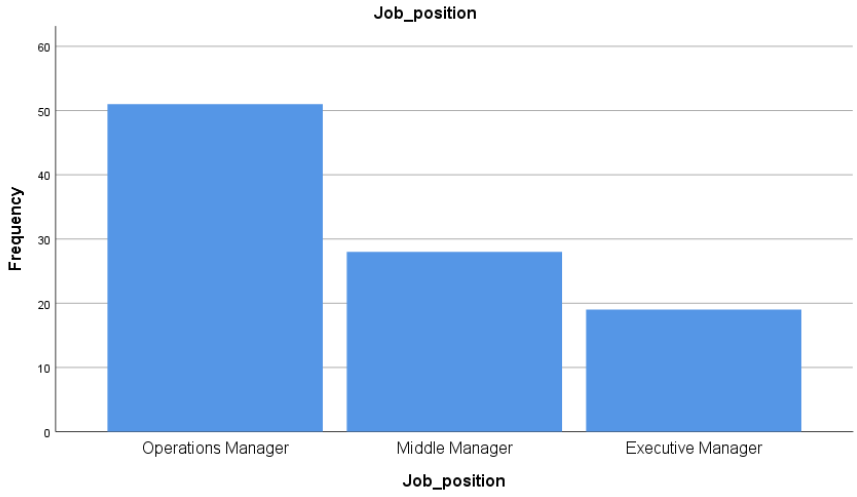

Figure 4-4: Histogram of Organizational Position.

4-10 Description of the main research variables

Before entering the information analysis stage, it is necessary to describe all the research variables. According to Table (4-5) descriptive statistics indicators of research variables are presented:

Table 4-5: Description of the main research variables.

Descriptive Statistics		TQM	GI	CSD
N	Valid	98	98	98
	Missing	0	0	0
Mean		4.21	3.54	3.19
Std. Error of Mean		.062	.073	.086
Median		4.00	3.50	3.00
Mode		4.00	4.00	3.50
Std. Deviation		.621	.728	.860
Variance		.387	.531	.740
Skewness		-.999	-.183	.095
Std. Error of Skewness		.244	.244	.244
Kurtosis		2.080	.023	-.253
Std. Error of Kurtosis		.483	.483	.483
Range		3.00	3.50	4.00
Minimum		2.00	1.50	1.00
Maximum		5.00	5.00	5.00
Sum		413.00	347.50	313.00

4-11 Inferential statistics

In inferential statistics, the researcher always deals with the process of sampling and selecting a small group called a sample from a larger group called the statistical population or the main population. The researcher uses the data and information obtained from the sample to estimate and predict the characteristics of the study population. The purpose of inferential analysis is to generalize the results of the researcher's observations in the selected sample to the main population.

4-11-1 Measurement model test

Structural equation modeling by PLS method includes two stages of measurement model test and structural model test. The measurement model test includes checking the reliability (internal consistency) and diagnostic validity. There are different criteria for evaluating the reliability and internal consistency of the model by PLS method, which are:

- Reliability of each item and variables observed,
- Composite validity of each structure (CR)
- Mean of variance extracted (AVE)

To measure the first criterion of reliability, we examine the reliability of each item. If the factor loads of each item on its own structure are significant, it can be argued that the items have sufficient validity. Factor loads are reported in the following tables. Factor load values greater than 0.5 are acceptable.

Table 4-6: Factor Loading of Variables.

	CSD	GI	TQM
Q1			0.83
Q10		0.80	
Q11		0.78	
Q12		0.82	
Q13		0.76	
Q14		0.50	
Q15	0.74		
Q16	0.74		
Q17	0.61		
Q18	0.64		
Q19	0.68		
Q2			0.79
Q20	0.69		
Q21	0.76		
Q22	0.83		
Q23	0.85		
Q24	0.75		
Q25	0.68		
Q26	0.56		
Q27	0.23		
Q28	0.69		
Q3			0.82
Q4			0.57
Q5			0.31
Q6			0.47
Q7		0.76	
Q8		0.33	
Q9		0.77	

As can be seen in Table 4-6, the factor load of questions 5, 6, 8 and 27 is less than 0.5 and these questions are removed from subsequent analyzes.

The second criterion of reliability is to examine the combined validity of each of the structures. Composite reliability, also known as composite reliability, is a more modern measure of reliability than Cronbach's alpha. This validity is obtained through the Dillon-Goldstein coefficient and values greater than 0.7 are acceptable for this criterion.

Also, the third reliability criterion is the mean variance extracted (AVE). The AVE criterion represents the mean of the variance shared between each structure and its indices. Values greater than 0.5 for this criterion indicate the appropriate reliability of the structure. Table (4-7) presents two CR and AVE criteria for research structures:

Table 4-7: Reliability of Research Variables.

	AVE	Composite Reliability
CSD	0.51	0.93
GI	0.57	0.90
TQM	0.63	0.87

In order to evaluate the validity of the research model, the criterion introduced by "Fornell and Larker" is used. This criterion shows the extent of the relationship between one dimension and its indicators in comparison with the relationship between that dimension and other dimensions of research. So that the acceptable divergence validity of a model indicates that one dimension in the model has more interaction with its indicators than with other dimensions. The Fornell and Larker criteria are obtained by saying that the square root of one dimension must be greater than the correlation of that dimension with other dimensions.

This criterion is presented in Table (4-8):

Table 4-8: Validity of Research Variable.

	CSD	GI	TQM
CSD	0.71		
GI	0.54	0.75	
TQM	0.65	0.71	1.00

In this matrix, the correlations of variables and latent dimensions are reported. The numbers on the original diameter of the matrix are the square root of the AVE. According to this criterion, if these numbers are higher than their lower numbers, it has a suitable validity. In Table (4-8) all dimensions have appropriate validity.

4-11-2 Structural model test

After ensuring the appropriateness of the measurement model, we review and test the structural model. Testing the structural model or research hypotheses includes examining the path coefficients (Beta), the significance of the path coefficients and the explained variance values (R2). Path coefficients show the effect of each of the independent variables on the dependent variable. Table (4-9) presents the path coefficients of the research variables:

Table 4-9: Path Coefficients.

	CSD	GI	TQM
CSD			
GI	0.76		
TQM	0.11	0.71	

As can be seen in the table, the effect of each of the independent variables on the dependent variables of the research is determined through the above table in the form of path coefficients. For example, the effect of focusing attention on organizational duality is 0.27. In order to evaluate the significance of the paths, t-statistic is used. The results of path significance test are as follows: values greater than 96 1.96 at the level of 0.05 and values greater than 2.66 at the level of 0.01 are significant. These results are presented in Table (4-10).

Table 4-10: Path Significance Test.

	CSD	GI	TQM
CSD			
GI	16.10		
TQM	2.01	30.41	

The following is the measurement model and the structural model of the research in the form of path coefficients and t-statistic:

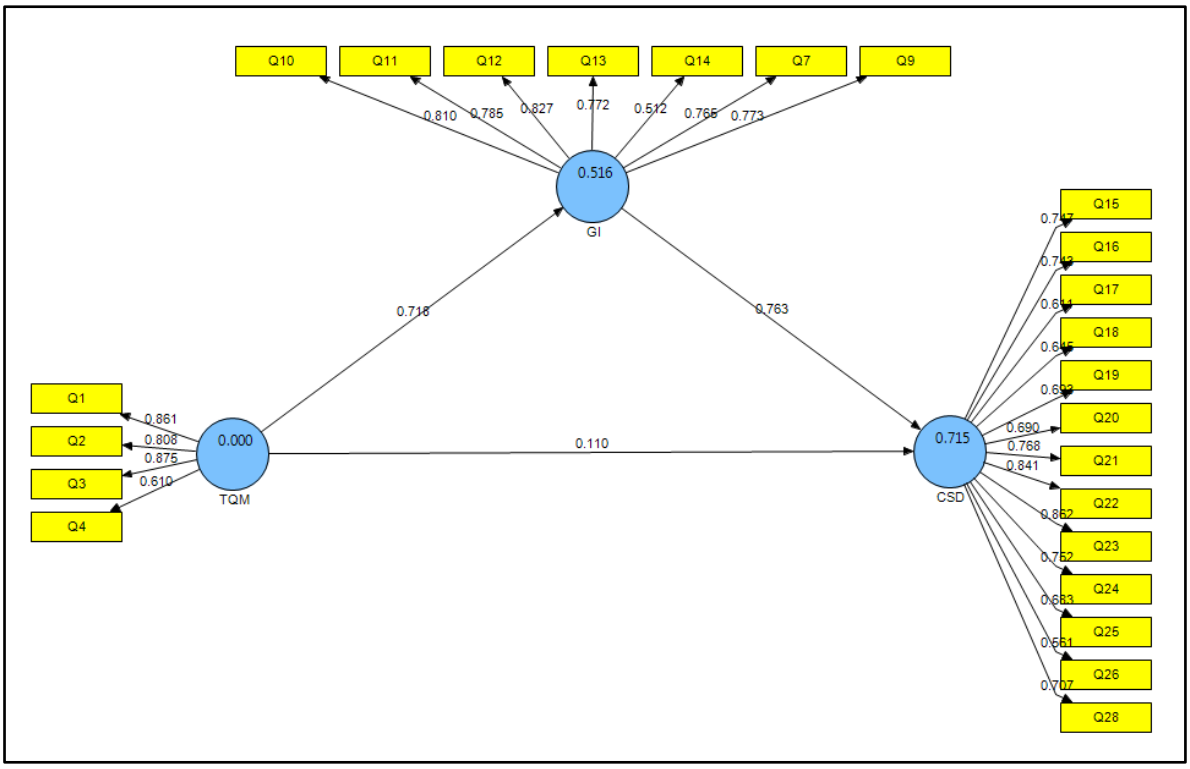

Figure 4-5: Path coefficients and factor loading of research variables.

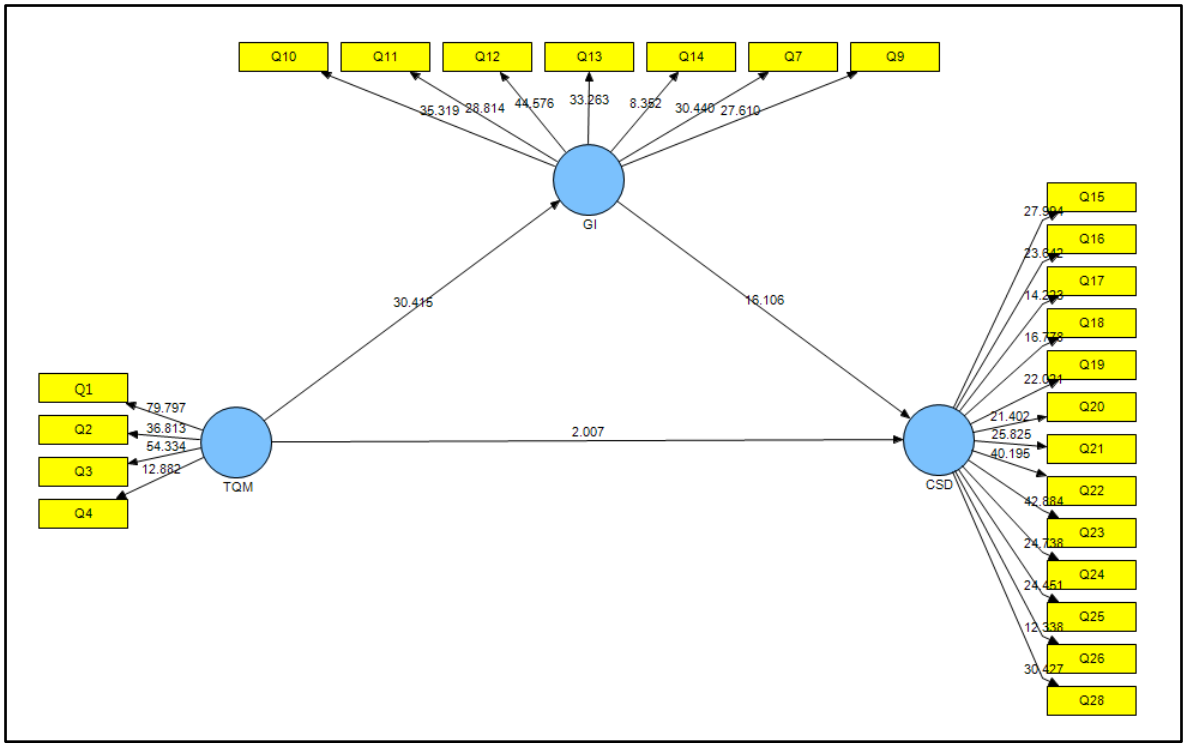

Figure 4-6: Statistics t / Significance of routes.

4-12 Test of research hypotheses

In this section, according to the significance test of paths and path coefficients, the research hypotheses are examined:

Table 4-11: Research Hypotheses.

No	from	to	Path coefficient	t	Test result
1	TQM	GI	0.71	30.41	Supported
2	TQM	CSD	0.11	2.01	Supported
3	GI	CSD	0.76	16.10	Supported

As can be seen in Table 4-11, according to the results of t-statistic, it can be said that all research hypotheses are significant at the 0.05 error level and are confirmed.

4-13 Investigation of structural model fit (model predictive power) through GOF criterion

The GOF criterion is related to the general part of structural equation models. This means that by this criterion, the researcher can control the fit of the general part after examining the fit of the measurement part and the structural part of his general research model. This criterion was developed by Tenenhaus et al. (2004) and is calculated according to the following formula.

$$\text{GOF} = \sqrt{\overline{Communalities} \times \overline{R^2}}$$

In the above formula (Communalities) is the mean of the common values of each structure and ($\overline{R^2}$) is the mean value of the explained variance of the endogenous structures of the model. In the partial least squares (PLS) method, Wezels et al. (2009) introduced three values of 0.01, 0.25 and 0.36 as weak, medium and strong values for GOF.

Table 4-12 calculates the GOF value for the research structural model. In

Table 4-12: GOF Criterion.

Variable	R Square	Communality	GOF
CSD	0.71	0.51	0.58
GI	0.51	0.57	
TQM	-	0.63	

The GOF criterion for the overall model fit is calculated to be 0.56, which indicates a very strong fit of the model.

4-14 Chapter Summary

The collected data are meaningless numbers that are used by statistics to make them meaningful in order to achieve research objectives. Information analysis as part of the process of scientific research method is one of the main foundations of any study and research by which all research activities are controlled and guided until you reach a conclusion.

In this study, the required information was collected from a questionnaire whose validity was tested. This information was analyzed using PLS and SPSS software using statistical tests in accordance with the research hypotheses. In this chapter, while introducing the research methodology, data were collected and analyzed based on statistical inference and statistical methods for confirming or rejecting research hypotheses are presented.

Chapter 5: Discussions, conclusions and suggestions

5-1 Introduction

The last chapter of each research activity consists of expressing the results and suggestions of the research. Chapter 5, in addition to being very important for the researchers themselves, is also very significant for the stakeholders or users of these results. Because the main function of this chapter is to use the suggestions provided and put them into practice to solve the problem that the research has been done to solve. With this introduction, in the fifth chapter, in addition to reviewing the summary of the results of describing the variables and comparing the results of the research with the results of previous research, an attempt is made to provide solutions and suggestions with the aim of improving the relationship between variables. It is necessary to Provide clarity as guidelines for future researchers.

5-2 Summary of Research Findings and Statistical Results

Hypothesis 1: Total Quality Management has a positive and significant effect on Green Innovation.

Based on the research findings, the size of significance coefficient (t-statistic) of this path is 30.41 and because this value is greater than the value of critical statistic 1.96, so the Total Quality Management of Green Innovation at the error level of $\alpha = 0.05$ was significant and according this relationship is positive to the path coefficient (0.71), which is in line with the research of Abbas and Sagsan (2020) and Fernando & et al. (2018).

The results show that Total Quality Management measures in PARS KHAZAR Industrial Company have an impact on Green Innovation.

Hypothesis 2: Total Quality Management has a positive and significant effect on the Sustainable Development of Company.

According to the research findings, the size of significance coefficient (t-statistic) of this path is 2.01 and because this value is greater than the value of critical statistic 1.96, so Total Quality Management on the Sustainable Development of Company at the error level of $\alpha = 0.05$ is significant and with Considering the positive path coefficient (0.11), this relationship is positive and significant, which is in line with the research of Abbas and Sagsan (2020), Vigtilik (2017).

The results show that TQM measures stimulate innovative environmental activities and its measures provide opportunities for managers of PARS KHAZAR Industrial Company for environmental cooperation.

Hypothesis 3: Green Innovation has a positive and significant effect on the Sustainable Development of Company.

According to the research findings, the size of the significance coefficient (t-statistic) of this route is 0.67 and because this value is greater than the critical statistic value of 1.96, so Green Innovation on Sustainable Development of PARS KHAZAR Industrial Company at the error level of $0.05 = \alpha$ It is significant and due to the positive path coefficient (0.76), this relationship is positive and significant and is in line with the research of Abbas and Sagsan (2020) and Alburt Monat & et al. (2018).

Researcher studies also show the positive impact of Green Innovation on Sustainable Development in PARS KHAZAR Industrial Company. moreover, Green Innovation has a positive impact on the company's economic performance and as a catalyst for PARS KHAZAR Company to achieve green technologies and green processes .According to the findings of this study, Green Management Innovation has the least impact on improving the sustainability of company performance, but in Long-term can improve the overall performance of the company. Consulting and monitoring costs in order to implement systems Environmental management can be considered as one of the reasons for the impact of Green Management Innovation on the performance of PARS KHAZAR Company.

5-3 Research Practical Suggestions

1. Given that industrial enterprises in Iran, such as PARS KHAZAR Industrial Company, today are considered as the main factor in the growth of the country's industrial structure

and this issue is priority in developing countries, so the following practical suggestions are expressed in the form of a series of policy recommendations.

2. Since Green Innovation in the two sectors of Green Management Innovation and Green Technology Innovation can be an important part of the strategic progress of PARS KHAZAR Industrial Company as a result of establishing a Total Quality Management system, the company's top managers should train and develop managerial skills in marketing, laws And make environmental regulations and the promotion of systems thinking their top priority.
3. Using the mechanisms of Total Quality Management system including knowledge and process management, customer orientation, supply chain management, human resource management, strategic planning and leadership in order to increase the organizational learning capability of PARS KHAZAR Industrial Company units and employees in order to change processes and thus achieve Green Innovation policies in the field of new products and services in order to develop the company's sustainability should be on the agenda of the company's senior managers.
4. Given the lack of financial and capital resources and the lack of specialized R&D departments in terms of the country's infrastructure constraints and the nature of industrial enterprises, one of the missing links is in the relationship between the dimensions of Total Quality Management, Green Innovation and Sustainable Development in PARS KHAZAR Group, so the establishment of a specialized parent company in the field of home appliance industry with the membership of small and medium enterprises related to this industry is proposed to solve their problems.
5. It is also suggested that the top managers of PARS KHAZAR Industrial Company in the design of Total Quality Management operations and its processes with the aim of implementing Green Innovation policies to try to Further communication of this industry with reference universities by carrying out engineering and management projects in team and group, make possible the grounds for solving issues related to the fields of quality and innovation and provide the development of the company's sustainability.
6. In general, given the current situation, Total Quality Management measures, Green Innovation and performance sustainability PARS KHAZAR Industrial Company, we should look for ways to improve the indicators of these variables in the company under study.

Thus related designs to promote development Sustainability to be more effective in PARS KHAZAR Industrial Company. On the other hand, by accepting the existence of a relationship between "TQM" and "Corporate Sustainability Development" should look for ways to create and develop optimal production and operations systems be in the company so that the Total Quality Management system can facilitate the development of the company's sustainability through Green Innovation.

7. The results show that the dimensions of Total Quality Management in PARS KHAZAR Industrial Company are appropriate and intermediate. This indicates that, considering the activities carried out in the past, more measures should be taken to upgrade the Total Quality Management activities in line with Green Innovation as well as the Sustainable Development of PARS KHAZAR Industrial Company.
8. In general, it should be noted that Total Quality Management measures in order to lead to Sustainable Development for PARS KHAZAR Industrial Company, should use the tools and upgrading systems that exist in the production and operations departments of the company. Also, the results of field analysis show that Green Innovation correlates between "TQM" and Sustainability Development""Manages effectively. In other words, this variable as a key component of PARS KHAZAR Company's strategic policies can affect actions Increase, decrease or even neutralize Total Quality Management as the company develops stability. Therefore, using Total Quality Management tools and systems in PARS KHAZAR Company can facilitate the achievement of Sustainable Development of the company. Therefore, the managers of PARS KHAZAR Industrial Company should pay attention to the role of Total Quality Management measures in order to promote Green Innovation and subsequently create and develop the company's sustainability.
9. In order for Green Innovation policies to be successfully implemented in PARS KHAZAR Industrial Company, its process must be carefully managed.

To do this, it is very important to be aware of the factors and variables affecting the outputs and consequences of the TQM in relation to the issue of Green Innovation.

The purpose of this study is to identify the impact of the dimensions of the Total Quality Management system on the Sustainable Development of PARS KHAZAR Industrial Company with regard to the mediating role of Green Innovation and to achieve this goal, the variables affecting Green Innovation, i.e. innovation goals, barriers, cooperation in the process Innovation and information resources required for innovation as independent variables of Green Innovation outputs including Green Management Innovation as well as

Green Technology Innovation and their effects on the development of firm performance have been studied.

10. About barriers to Green Innovation, financial constraints and barriers PARS KHAZAR Industrial Company is one of the most important obstacles in the formation of Green Innovation, which prevents the realization of the achievements of the establishment of a Total Quality Management system in relation to the development of sustainability of the company under review.
11. PARS KHAZAR Industrial Company must always act for continuous improvement and therefore the top managers of the company must clearly define innovative strategies for the company. In this regard, Green Management Innovation, the ability to participate in the development and implementation of green projects with the program Planning and allocating appropriate budgetary resources such as redesigning production processes to achieve higher efficiency, green supply chain management and environmental management systems Introduces new environmental standards.
12. To achieve this dimension of Green Innovation must develop green goals and strategies and a specific budget for thinking Innovative green in PARS KHAZAR Company. Among the measures taken by PARS KHAZAR Company to achieve this dimension Green innovation helps to successfully implement the ISO 90444 series of standards, save resources, prevent the release of harmful substances into the environment and hold and mentioned seminars to educate and raise the awareness of stakeholders.
13. In order for Green Innovation to be successfully implemented in PARS KHAZAR Industrial Company, its process must be carefully managed.

    To do this, it is important to be aware of the factors and variables affecting the outputs and consequences of Green Innovation.

    The aim of this study was to identify the impact of the main dimensions of Total Quality Management on the output of Green Innovation in both Green Management Innovation and Green Technology Innovation so that the effects of Green Innovation on the performance of PARS KHAZAR Company and sustainable development as a result of system establishment Total Quality Management Examined.
14. Redesigning how to provide customer service with the aim of environmental guidelines for the development of PARS KHAZAR Industrial Company helps to be environmentally friendly.

15. Development of managerial and technological innovations to achieve sustainable development and innovation in products that lead to sustainable development of PARS KHAZAR Industrial Company.
16. Reducing transaction and tax costs for the purchase and import of production equipment, which leads to Green Innovation and Sustainable Development of PARS KHAZAR Industrial Company.
17. The development of environmental monitoring systems in PARS KHAZAR Industrial Company is proposed to identify and track the level of pollution and environmental hazards to reduce damage to the environment.

5-4 Research Limitations

The present study has some limitations:

1.The most important limitations of this research that the researcher faced in the present study were lack of time and lack of easy access to everything Members of the statistical community as well as respondents' reluctance to provide information to complete the questionnaire mentioned that using Behavioral techniques improved. In addition, according to the research findings, it is suggested that managers as much as possible to infrastructure.
2. The research questionnaire has been collected by the managers of PARS KHAZAR Industrial Company and the opinions of employees and operational workers have been ignored, but their opinions can provide valuable insights to future researchers.
3. In this research, the financial data of PARS KHAZAR Industrial Company (due to confidentiality) such as annual financial reports have not been used to measure the economic dimension of the company's performance.
4. Completing the questionnaire in a self-report manner in most cases, although it is a common method in various researches, but it may cause some orientations and intentions in the executive managers and the results may be accompanied by some biases. However, in this regard, the researcher tried to reduce the negative effects of this restriction to some extent by using anonymous questionnaires and not abusing the collected information.
5. Since the data of this research has been collected only from PARS KHAZAR Industrial Company in the home appliance industry, so there may not be conditions for generalizing the results to other industries.

5-5 Suggestions for Future Research

1.Organizational structure of PARS KHAZAR Company to empower different dimensions of Green Innovation, especially Green Technology Innovation, which based on research findings is the most has an impact on improving the sustainability of the company's performance, by diligent managers and applied in the company Given that the results of the research show that innovation of Green management, which has a weak impact on improving the performance sustainability of PARS KHAZAR Company, is suggested: In a study on the impact of green managerial innovation components to address the organizational performance of the company using another model and the results with the results of this research be compared.

2. Using a small dimension in studies related to the economic development dimension of PARS KHAZAR Industrial Company, which will show the facts related to the increase of this dimension after the sustainable development of the company.
3. Using the green identity of the organization with organizational innovation in PARS KHAZAR Industrial Company.
4. The use of green human resources for the sustainable development of PARS KHAZAR Industrial Company is recommended for future research.

5-6 Chapter Summary

In this chapter, while discussing the results and findings of the research and presenting suggestions in line with the objectives of the research, the limitations of this research are pointed out and recommendations are made for future researchers.

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Appendix (I): Research Questionnaire

Dear respondent

Greetings and Regards

The attached questionnaire has been prepared in order to collect the required data for the master's thesis entitled:

"Impact of Total Quality Management Practices on Corporate Sustainable Development with Emphasis on Green Innovation in Manufacturing Companies "(Case Study: PARS KHAZAR Industrial Company in Iran)

The time required to answer this questionnaire is estimated at approximately 10-15 minutes. Since the achievement of correct and valid scientific results depends on your valuable comments, so please provide the required information from this questionnaire by providing accurate answers to the questions raised.

Thank you for your sincere cooperation.

Ataollah Taleghani

Student of Master of Science (Engineering and Management)

POLITECNICO Di TORINO UNIVERSITY

1. How do you evaluate the impact of leadership style on the performance of the Total Quality Management system?
*very little *little * medium * much *very much
2. How do you evaluate the impact of knowledge management and its process on the performance of the TQM system?

*very little	*little	* medium	* much	*very much
3. How do you evaluate the impact of customer orientation on the performance of the Total Quality Management system?				
*very little	*little	* medium	* much	*very much
4. How do you evaluate the impact of strategic planning on the performance of the Total Quality Management system?				
*very little	*little	* medium	* much	*very much
5. How do you assess the impact of supply chain management on the performance of the TQM system?				
*very little	*little	* medium	* much	*very much
6. How do you assess the impact of human resource management on the performance of the Total Quality Management system?				
*very little	*little	* medium	* much	*very much

How do you evaluate the impact of green technology innovation on the realization of green innovation with the following?

1. To what extent do the company's new products use less environmental pollutants?				
*very little	*little	* medium	* much	*very much
2. To what extent are environmentally friendly products used to package the Company's new products?				
*very little	*little	* medium	* much	*very much
3. How much recycled material is used in the company's new products?				
*very little	*little	* medium	* much	*very much
4. How much recyclable materials are used in the production of the company's new products?				
*very little	*little	* medium	* much	*very much

How do you evaluate the impact of green management innovation on the realization of green innovation with the following?

1. To what extent is company management committed to environmentally friendly policies?				
*very little	*little	* medium	* much	*very much
2. To what extent does the company's management regularly review and redesign its strategies to comply with environmental standards?				
*very little	*little	* medium	* much	*very much
3. To what extent is the company's management ready to adopt a new system or improve the existing management system according to environmental policies and procedures?				
*very little	*little	* medium	* much	*very much
4. To what extent does the company's management guarantee its production and operational activities in accordance with environmental laws?				
*very little	*little	* medium	* much	*very much

How do you assess the impact of environmental sustainability on the company's sustainable development in terms of the following?

1. To what extent do the company's products have less environmental impact than in previous years or compared to competitors?				
*very little	*little	* medium	* much	*very much
2. To what extent have the company's environmentally harmful processes been removed from production processes?				
*very little	*little	* medium	* much	*very much
3. To what extent has the company's environmentally harmful operations been eliminated in sensitive locations?				

*very little	*little	* medium	* much	*very much
4. To what extent has the company's production waste been reduced by simplifying processes?				
*very little	*little	* medium	* much	*very much
5. To what extent does the company use waste as input to other processes?				
*very little	*little	* medium	* much	*very much

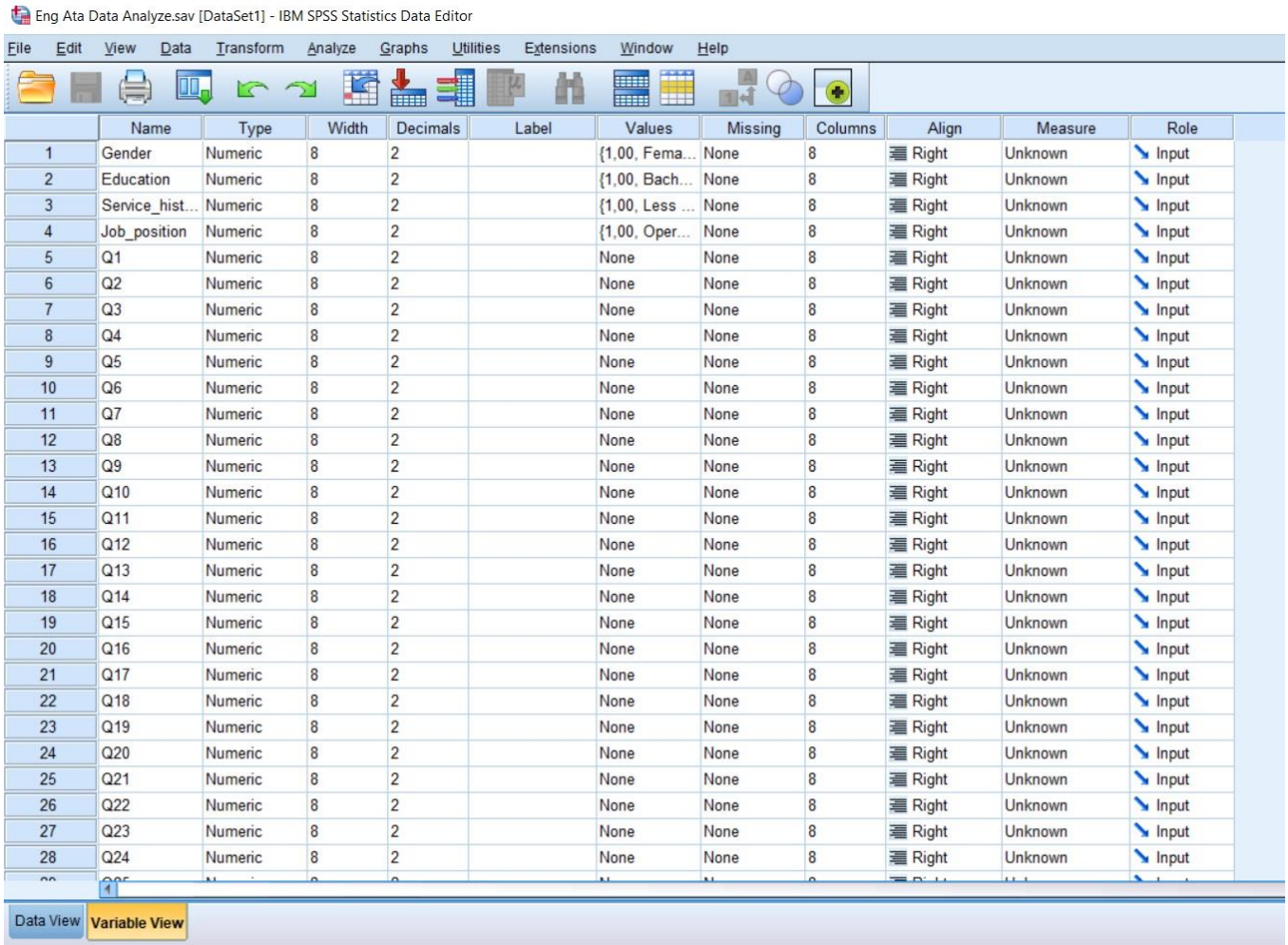
How do you assess the impact of social sustainability on the sustainable development of the company?

1. To what extent does the company consider the interests of stakeholders in investment decisions?				
*very little	*little	* medium	* much	*very much
2. How important is it to improve the health and safety of employees for the company?				
*very little	*little	* medium	* much	*very much
3. To what extent does the company inform the public about environmental impacts and risks?				
*very little	*little	* medium	* much	*very much
4. To what extent does the company support the claims and rights of indigenous peoples and the local community?				
*very little	*little	* medium	* much	*very much
5. To what extent does the company recognize the need to fund local community initiatives and take action on them?				
*very little	*little	* medium	* much	*very much

How do you assess the impact of economic stability on the sustainable development of the company?

1. To what extent has the company reduced waste management costs for the same level of output?				
*very little	*little	* medium	* much	*very much
2. To what extent has the company reduced input costs for the same level of output?				
*very little	*little	* medium	* much	*very much
3. How much does the company earn from the sale of its production waste?				
*very little	*little	* medium	* much	*very much
4. To what extent can a company operate efficiently in other areas of business by creating silent technologies?				
*very little	*little	* medium	* much	*very much

Appendix (II): Software Analysis Output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12	Q8	Numeric	8	2		None	None	8	Right	Unknown	Input
13	Q9	Numeric	8	2		None	None	8	Right	Unknown	Input
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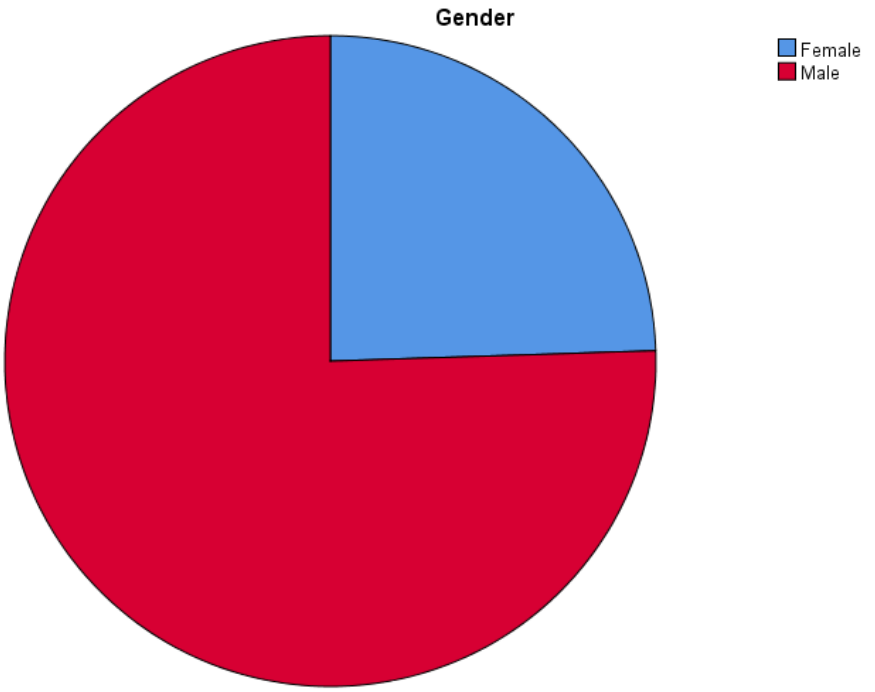
Data View Variable View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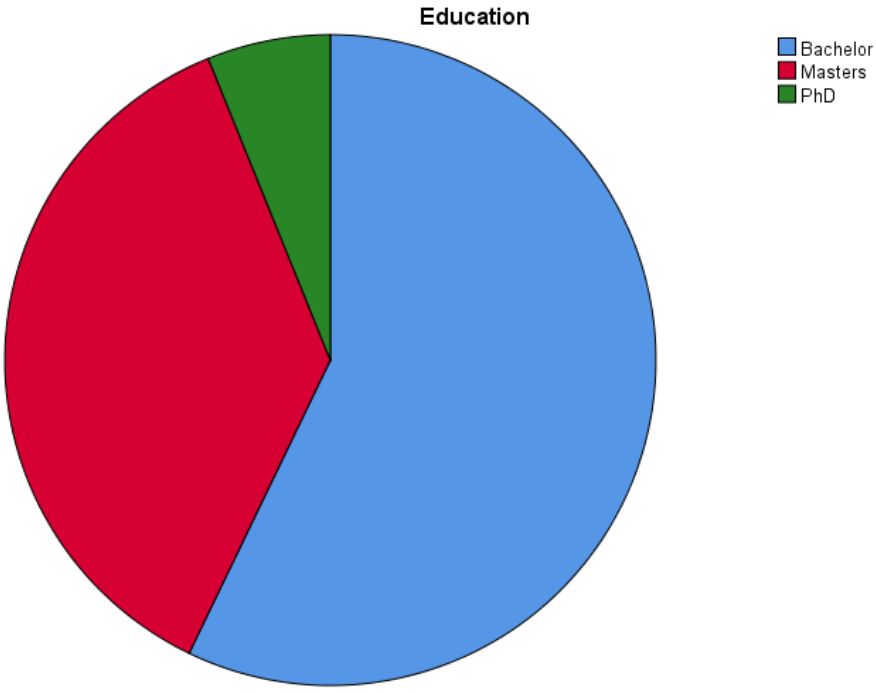
Male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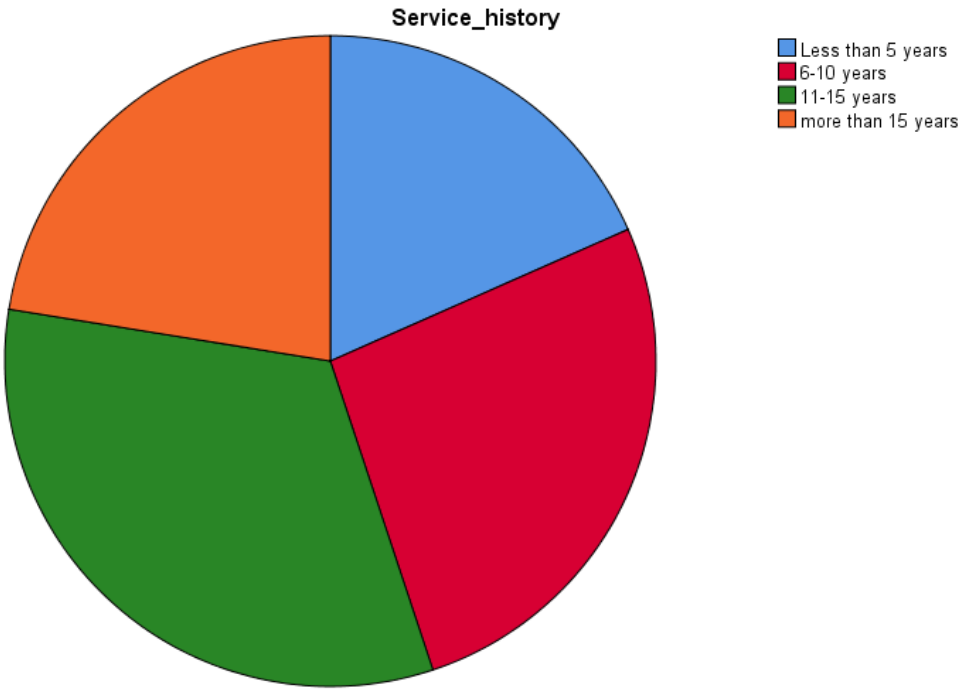
PhD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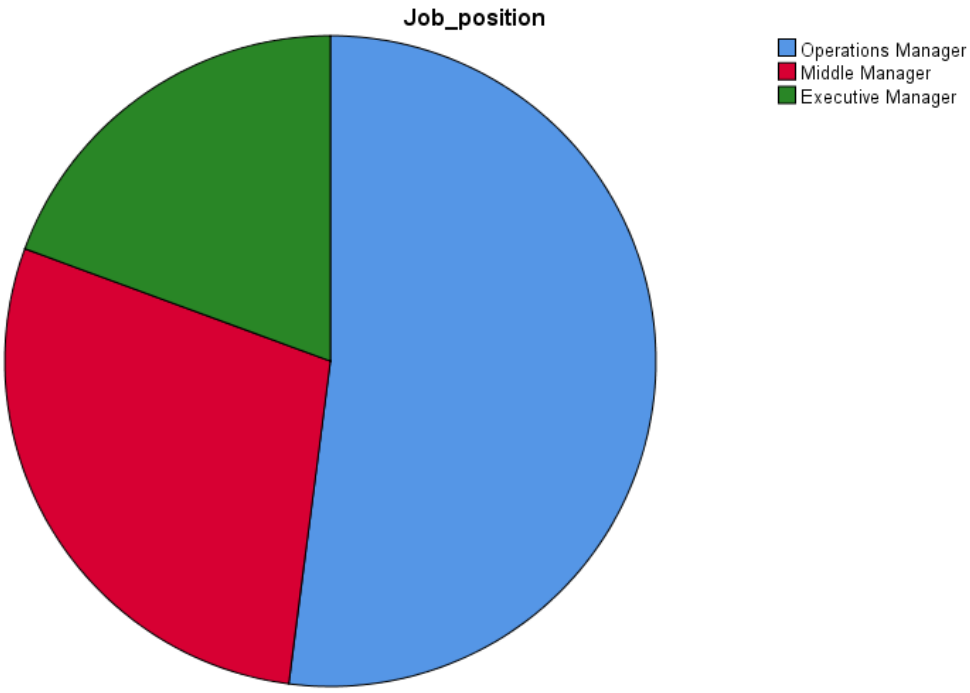
11-15 years
more than 15 years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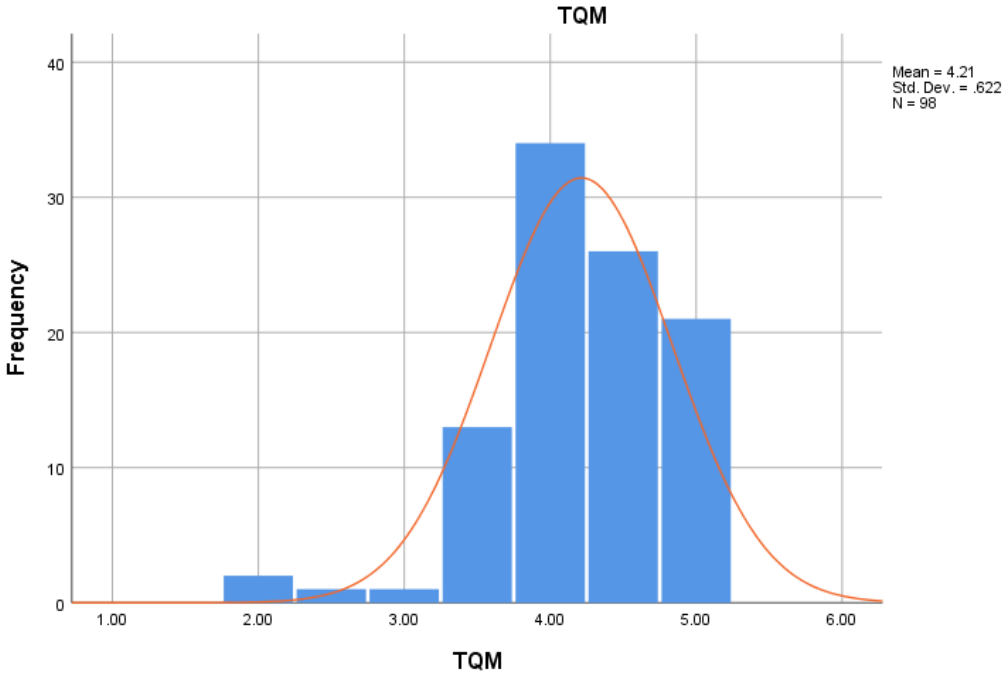
Executive Manager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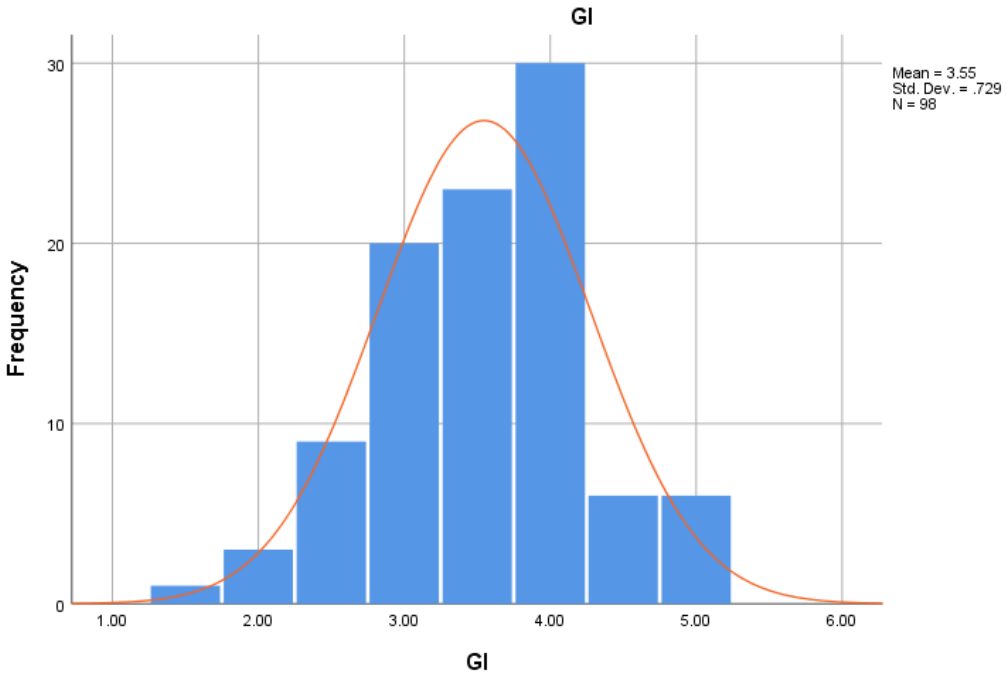
TQM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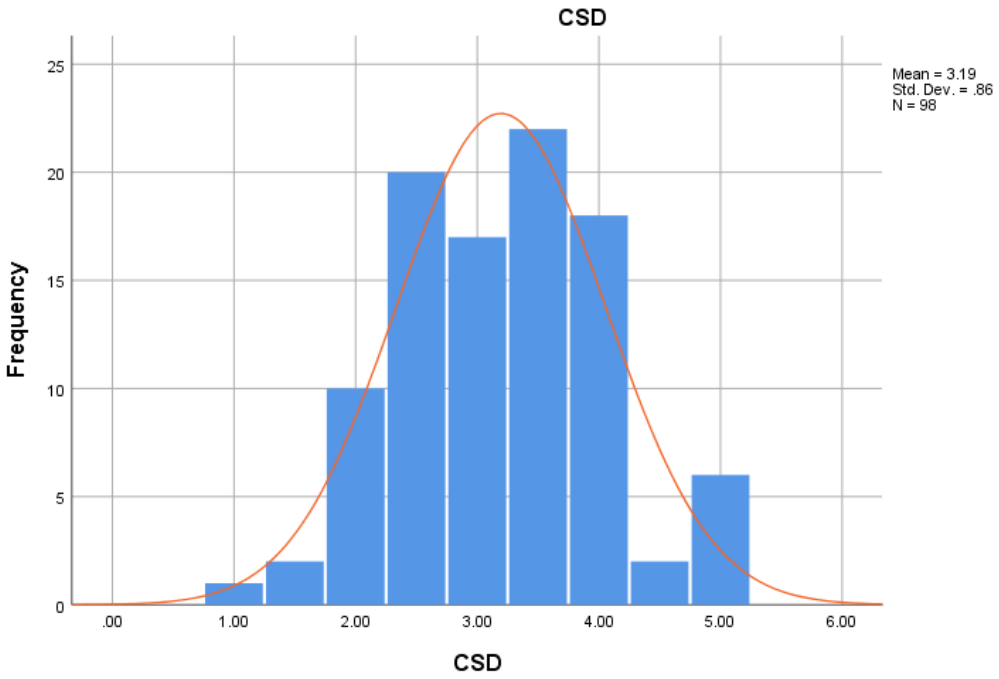
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CSD