

# The application of the six-diffraction methodology (DMAIC) in improving the work of the modern Diwaniyah water project (Case study: Al Diwaniyah Water Directorate)

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## ABSTRACT

The research aims to identify the obstacles facing the Diwaniyah Water Directorate in producing drinking water using the six-diffraction technique and thus improving the services provided by it, The case study method was used to study the reality of the work of the Diwaniyah Water Directorate (the modern Diwaniyah water project) which is one of the largest operating projects In Al-Qadisiyah governorate, which supplies the governorate center with drinking water, and data were collected through the survey form, personal interviews, records and documents, personal observation, the DMAIC methodology was used in the stage of producing drinking water which is (the source of raw water and the filtering project). It works on studying the existing problems in depth and improving the quality of the production process, by using a number of quality tools in the analysis stage of the (DMAIC) methodology, namely (Pareto analysis, cause and effect diagram) .

The research found the possibility of Six Sigma diffraction technology application in addressing problems and finding solutions in the research sample (water project Diwaniyah talk where it was found that low levels of river water and plankton in greatly affect the work of the project) and reduce the amount of total production of drinking water in addition to interruptions Frequent electric current, especially at the time of the atom.

One of the main recommendations of the need to adopt Quality Management in the work of the Directorate of Water Diwaniyah and Technology Diffraction hexagon to reach the required quality and coordination with the Ministry of Water Resources to ensure the launch of the water quota sufficient to operate water projects in the province and coordination with the Ministry of Electricity need for the project is equipped with electricity continuously and without interruptions and work by Directorate of water Diwaniya and the provision of interest generators and fuel oils in the event of electrical power failure and the development of emergency plans in the event of power outages, especially in times of peak usage in the summer.

### Keywords:

Analysis, Measure , Define, Control , Improve , Low water levels in the river, Plant Achammblan .

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## Introduction

The water sector is one of the important sectors affecting the lives of citizens in providing safe drinking water and building infrastructure in coordination with other sectors.

The aim of the Directorate of Water Diwaniyah water distribution of drinking all citizens in Qadisiyah province, through the central projects main and branch lines that the Directorate continuously develops its work through the creation of new projects and the maintenance of labor, including building new networks and maintenance of old networks according to the plans and future programs It is

prepared by specialists for this purpose .

### First: Research Problem:

In view of what some neighborhoods in Qadisiyah are suffering from lack of access to safe drinking water, due to the delay in implementing or supervising projects, whether from the development of regions and governorates, investment plan projects or on the budgets of the Diwaniyah Water Directorate, which is negatively reflected without providing services at the required level Limit the research problem to the following questions

- 1- What are the obstacles that prevent the provision of drinking water, especially in the Qadisiyah

governorate?

- 2- Can the DMAIC method be used to improve the work of the modern Diwanayah water project and address the problems present in it?

### **Second: Research objectives:**

The research aims mainly to identify the problems facing the Diwanayah Water Directorate, especially the modern Diwanayah water project, and thus improve the services provided by it by finding solutions to the problems present in the drinking water production phase in order to improve the service reality in the governorate, where it witnesses repeatedly In some neighborhoods, drinking water is scarce in the summer, without solutions to end this problem .

### **Third: Research methodology:**

The researcher relied on the case study method, which is one of the descriptive studies used to test a hypothesis or a group of hypotheses, and this approach relies on collecting comprehensive information and data about the case or a specific number of cases in order to reach a deeper understanding of the studied phenomena through personal observation that the researcher is one of the workers in the Water Directorate He has access to and knowledge of the work of the Directorate, as well as through personal interviews with engineers and technicians for the purpose of unifying ideas and identifying the main problems to obtain real information using the exploratory form shown in Appendix (1), then using the (DAMIC) methodology, which is to understand, measure, analyze, improve and control the various processes and their stages The Five:( Define: Defining the problem, explaining its importance and its impact in providing the service, Measure: Using the Pareto Diagram to determine the problem most affecting the work of the liquidation project, Analyze: Studying the root and subsidiary causes of the most influential problems, Improve: Developing a set of proposals to address the existing problems, Control: Review Measuring measures), then laying out the conclusions reached by the study and the recommendations required to be undertaken for improvement The service provided and avoiding problems in producing drinking water.

### **First topic:**

#### **First: Six Sigma diffraction:**

In the eighties, quality management was very common and the focus was on developing programs, and this method began to slow down after the spread of the concept of globalization in all aspects of life and the start of

competition between various production or service companies, which aspire to provide the best services in order to maintain customers and gain their satisfaction, so it was done orientation to use new methods to reduce defects and provide the service or item at a reasonable price to the customer and reduces the risk because of competition Akabarh between service organizations and productivity.

Therefore, new and advanced methods of reducing defects have been started, including the Six Sigma method, which is a very disciplined method that helps organizations reach a high degree of quality and perfection.

Although there is a prevailing belief that achieving high quality costs a lot of money, effort and time, and this concept is wrong, the correct concept is that the higher the quality, the lower the cost and time, and the greater the profit, and this is the new concept of using the highest quality (Six Sigma) to achieve the lowest costs.( Harry and Schroeder:2008,24), (alnajar and jawad:2017,320-321).

There are many definitions of six Sigma as defined by the (Krajewski & Ritzman, 2005 : 221 ) As a flexible and comprehensive system to support and achieve success in the business as far as possible, And knew (alnajar and jawad:2010,381) It's a comprehensive and flexible philosophy for organizations to maximize the success and maintain, and is moving towards an accurate understanding of customer's needs, and use of facts, data and statistical analysis and attention to the improvement and development of processes in the organization, And knew (Brue,2002:2 ) It's a concept used in the statistical measurement of process defects based on the six levels of diffraction.

### **1-DMAIC methodology:**

In the current era of successful service organizations it started dealing style business management organizations in terms of the mechanism of action and systematic thinking, even if those did not provide service organizations, business or activities require them to invest their money or services, and therefore there are many aspects witnessed by organizations in various types of changes Radical management methodology and methods used in strong competition in order to distinguish in work and innovation and follow quality management to reach high degrees of meeting the desires and satisfaction of customers or beneficiaries.

Although the DMAIC methodology has its roots in manufacturing, it works just as effectively in service industries, as service organizations have different root causes for problems and a unique set of processes and metrics, so the tools and methodology required to achieve vastly different improvements. The problems in a manufacturing setup may reside in the process, the problem in service is often the process itself.

The (DMAIC) model is implemented through five stages that are the initials of each word in these stages, which are represented by (Define, Measure, Analysis, Improve, and Control) and the following are an explanation of these stages. (Al-Naimi, sawis:2008,48)

### **Define:**

During this stage, specialists begin to define the main goal of improvement, as the Six Sigma team determines the processes that need improvement, depending on the objectives of the organization and the needs and requirements of the customer, and determines the quality characteristics that have a direct impact on quality in products and processes, which leads to the creation of an image It is clear about the processes that need to be improved, and since the main goal of the ( 6 sigma) is to reduce the number of defects by solving the problems that cause them, so the definition of the problem is considered one of the important matters in the success of the application of the (Six sigma) approach and giving a clear picture of the problem in the organization. [www.realinnovation.com/content/c070319a.asp](http://www.realinnovation.com/content/c070319a.asp)

### **Measure:**

At this stage, an appropriate scale and standard is chosen to be required in evaluating the success of the specific and designed projects, and the appropriate quality characteristics of the processes and outputs that meet the customer's desires are chosen, the number of defects resulting from the processes and the inputs that contribute to the occurrence of these defects, and knowledge of the impact resulting from Reducing and eliminating defects on the organization's profits and in reducing costs, and measuring defects that have a direct impact on quality characteristics, and thus it is possible to know the level of sigma of the processes that are calculated based on the number of defects, which is used as a basis for comparison with improvement projects, and at this stage it requires collecting data to solve the problem in words Last set quantitative values for operations that have an impact on the gap, measure what happened accurately, convert the problem into a function to measure defects, and prepare for its analysis.

### **Analysis:**

At this stage, the development of hypotheses about the real causes of the problem is started, and these hypotheses are either proven correct or refuted by analyzing the main causes of the problem, and the primary causes and the most important causes that are identified are the cause of the appearance of defects in the product, and from the tools that are used in this Stage( Pareto Diagram, Cause-Effect Diagram, Why-Why Cascading Analysis) plus Quality Control Tools (alnajar and jawad:2017,322), .( Al-Naimi,

sawis:2008,94)

### **Improve:**

After determining the main causes of the problem in the previous stage, at this stage, work on improving processes is started, where ideas and solutions are developed in order to get rid of the main causes of the problem, then we test the solutions formulated and implement them and make sure that they are appropriate to the capabilities of the organization and are comfortable for it. This stage includes the required characteristics and standards in the performance of the product that must undergo changes to reach the main objective of the organization.

### **Control:**

The improvement process needs to be continuously monitored and controlled, as this stage is considered the sustainable part of the entrance to sex, as the most important thing that must be monitored is to ensure that there is no return to the old traditional practices that caused the occurrence of problems and disabilities, and accordingly, the ultimate goal is to perpetuate Positive effects, and ensuring their continuity, with the need to measure and monitor the results in parallel (slack,chambers&johnston,2004,65).

### **2-The benefits from applying the methodology (six sigma):**

The financial benefits achieved as a result of applying the sex curriculum are among the important reasons that pushed international organizations and companies to apply this approach and among these benefits. ([www.isixsigma.com](http://www.isixsigma.com))

- 1-The increase in the level of the generated revenues.
- 2-Reduced costs borne by the organizations.
- 3-Decrease in poor quality costs.
- 4-Decrease in production costs.
- 5-he rise in the market value of shares.
- 6-The rise in the rate of return on investment.

### **3- Quality tools**

Quality tools are among the main elements in the successful implementation of quality management in organizations, which help in evaluating and reviewing the organizational performance periodically to ensure the achievement of quality objectives. (Al-Tarawneh,2011:9).

### **- Quality management tools used in the (DMAIC) methodology:**

#### **a-Pareto Chart:**

It is a chart that tries to isolate the main dominant factors that affect the situation from many unimportant factors, the rectangles of the chart are arranged from the highest value on the left to the lowest value on the right, the vertical axis may represent the frequencies or the relative frequencies (Haksever and Render2013:351).

Pareto, the Italian general in economics, concluded that 20% of the population in the world owns approximately 80% of the wealth in it, and on this basis he set his famous rule of "influential few" or (20: 80) as the scientist Pareto followed a number of phenomena and found That 20% of patients consume 80% of medicines and 80% of the time of workers in health institutions, and 20% of workers in organizations perform 80% of the total work of the organization, and so on for more than ten indicators that Pareto followed in various fields, and based on these indicators he developed This is a quality tool that helps in identifying the causes affecting the phenomena that are being studied (Ronen et al. , 2006 : 29-30).

#### **b-Cause- Effect Chart:**

Cause-effect diagrams were developed by Japanese quality expert Kaoru Ishikawa. These diagrams are also called fishbone skeletal diagrams. They are powerful tools that help quality improvement efforts focus on finding the causes of a specific problem. The diagram contains a midline, or "spine" , Which leads to the "effect" or the main problem, and some of the main categories of potential causes associated with the spine, the causes of most quality problems can be grouped into general categories such as people, equipment, methods, materials, processes, environment, or specific classes of problem that can be used after So in the brainstorming session, potential sub-causes, sub-branches, etc. are identified in each category, and at the end of the session every element in the chart is examined and removed if it is not a factor contributing to the problem, the remaining causes are closely examined, and if a link is found. Between it and the "impact" or problem, efforts to

improve quality are directed towards eliminating it (Haksever and Render2013:353).

The cause-effect diagram is characterized by being an adept tool in analyzing the causes of a specific problem or effect and the relationship between cause and effect, and fishbone diagrams are used to describe a specific case on paper, and the primary goal of a cause-effect diagram is to find out the root causes of existing problems (Kulkarni&Bewoor,2009:159).

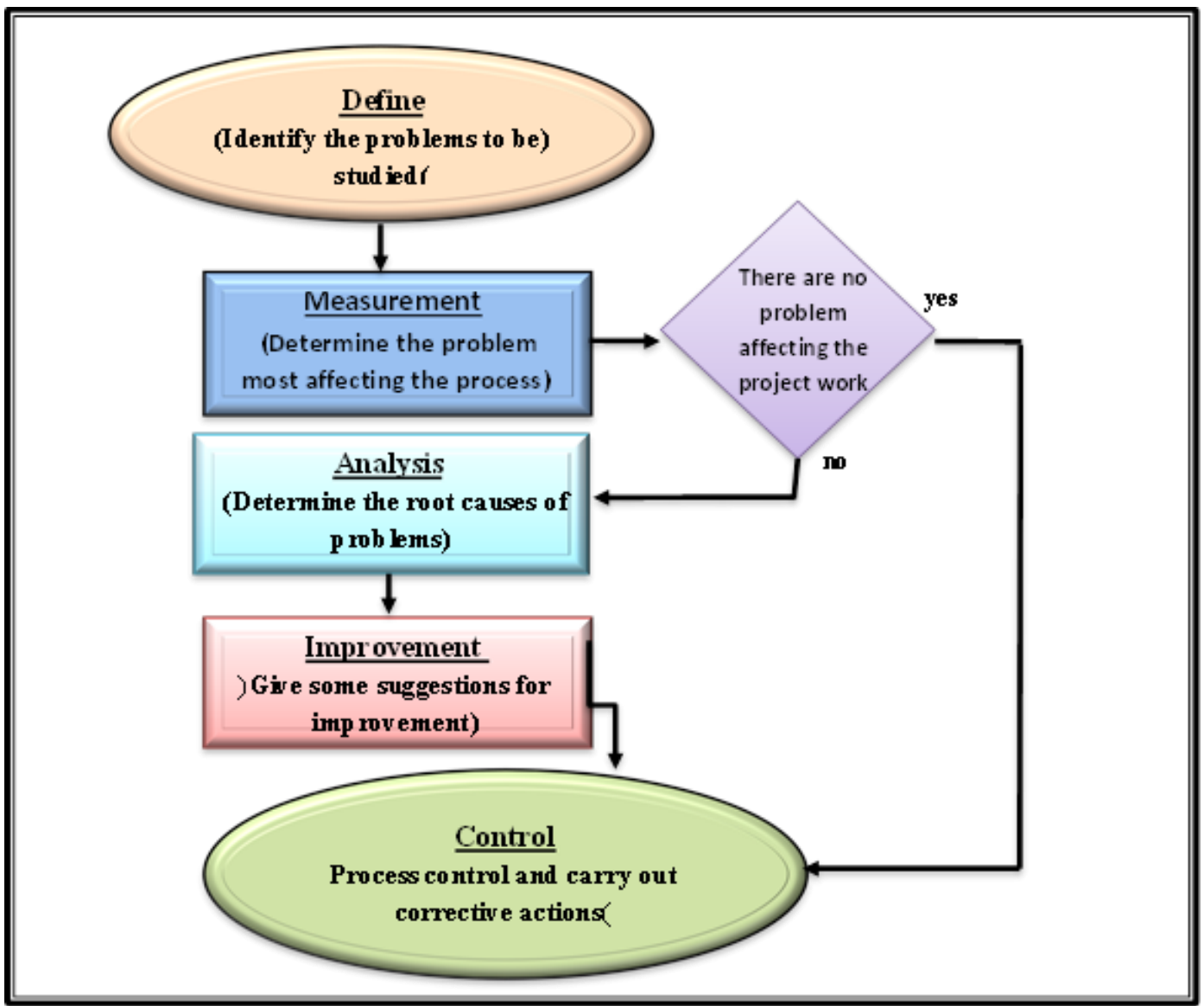
#### **c- Sequential analysis of the reasons (Why-Why):**

This tool is used in analyzing the main problem to find the root causes of the problem. After identifying the problem, the question is asked about the reasons for the occurrence of each of the causes of the sequence itself, up to the root cause of the problem. Lead to the root cause of the problem, and the apparent cause of a problem often leads you to another question, and although this technique is called (5Why) you may find that you will need to ask a question less or more than five times before you find the problem related to the main problem. The type is not new with the emergence of (Six Sigma), but it is often used in the analysis phase of the (DMAIC) methodology, especially when there are no important data on the main problem (SlackandJones,2018:446).

#### **The second topic:**

##### **First: the application of the( DMAIC ) methodology:**

The ( DMAIC ) methodology consists of five stages, and for each stage, some quality control tools and techniques are used, depending on the data in the research community, field visits to the project and personal interviews of the sample in order to know the reality of the project's work, conduct the analysis and make the required improvements and Figure 1 illustrates how the methodology (DMAIC).



**Figure( 1 ) illustrates how the methodology (DMAIC).**

In order to further verify the results, and by relying on the role of specialists and their accumulated experience in the Diwanayah Water Directorate and the modern Diwanayah water project, an exploratory form shown in Appendix (1) was used to indicate the most important problems in the stage (source of raw water and the filtering project) in order to diagnose the main and subsidiary causes of the problems. , In addition to the number of recurrences of this problem at this stage, as it was presented to the specialists in the field of quality and by the teaching staff, and an intentional sample of (50) engineers and technicians was used.

**1- Raw water stage and filter project:**

**A: The definition stage:**

The stage of raw water and the filtering project is considered the stage of starting and starting to provide the service to the beneficiaries, as it is considered one of the most important stages and most influencing the subsequent stages in the delivery of potable water, as it is the first responsible for production, as well as the absence of alternatives in the event of any defect in the processing or stopping the project, In order to know more about the project, the Project Charter tool was used, as this tool provides clear and concise information about the project in which problems are to be addressed and improved in order to work on finding solutions and provide the capabilities to get rid of them, as shown in Table (1).

Project Title	Application (DMAIC) methodology in the project research sample
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The site	Iraq - Al-Qadisiyah Governorate
Place project application	Modern Diwaniyah water project
The design capacity of the project	12000 m <sup>3</sup> /hour
Established year	2014
The aim of applying the (DMAIC) methodology	Addressing the problems that affect the work of the project and that reflect negatively on the reality of the services provided and finding solutions to them
Tools used	Project Charter, pareto chart ,cause and effect

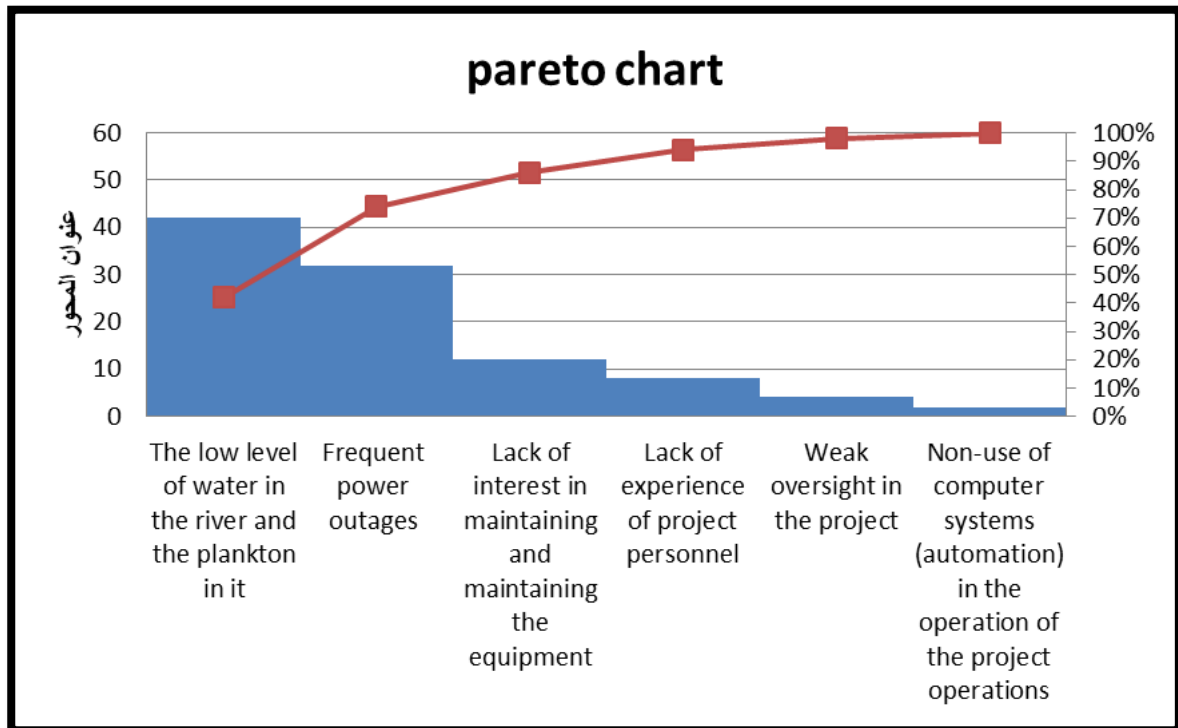
Table (1) Project Charter

For a serious study of the problem right and work to gather information about them and in the form will be used form reconnaissance in Annex (1) to determine the most problems, the impact at this stage, and arranged according to the importance and the collection of a number of ideas and opinions about the causes and these problems or flaws.

**b- Measurement:**

It is the second stage of the DMAIC methodology, and the purpose of this stage is to collect data and facts related to the problems faced by the project, and the measurement is very important in determining the most important problems that this stage is going through, so the use of (Pareto analysis) or the so-called (low impact), which is One of the quality tools that work to identify and distinguish the most influential problem through the exploratory form in the stage of raw water and the filtration project that was distributed to the intended sample of

engineers and technicians and taking their opinions about the biggest problem at this stage of the project's work and the researcher's keenness to distribute it to the engineers and technicians owners Experience in this field from within and outside the project, and to represent the problems graphically and arrange the causes in a descending order from the most frequent to the least in order to identify the most important and most influential problems and focus on solving them first, as the Pareto principle is based on the fact that (80%) of the problems leads to (20%) One of the causes (obstacles), therefore, Table (2) shows the most important causes of the problems that occur on the first trip of distributing potable water (source of raw water and the filtering project), and then arranging them according to the frequency Show it and then calculate the relative repetition of the problems, as shown in Figure (2) of the Pareto chart.



**Figure (2) of the Pareto chart.**

Shows us (Figure 2) that the problem is the most influential is the (low levels of the river and the presence of plankton such as plant Achammban) as well as the problem of (power outages frequently) that are making the highest percentage of problems, which will be analyzed and studied in the analysis stage to see sub-causes that affect On it, and stand on the most important points to control them and work to improve them, as if these two problems are solved, (74%) of the problems that the Directorate suffers from in this area will be solved.

c- Analysis:

After the measurement stage, the analysis stage comes to provide a clear view of the main and secondary causes that led to these problems in the first stage, so the tool (Cause plankton decline. **Table 1 Number of community**

and Effect Diagram) was used for the problem (low river levels and the presence of plankton) and the tool for successive analysis of the causes (5 why) of the problem (power outages frequently) in the analysis of the most important diagnosed causes that have a major impact on the modern Diwaniyah water project and to know the roots and causes of these causes in a scientific way to reach a clear perception of the problems, and in a more realistic way and to determine the appropriate treatments to reduce these causes, through personal interviews with specialists In this field, to identify the secondary causes at this stage. Figure (3) shows the cause and effect diagram for the problem of raw water and

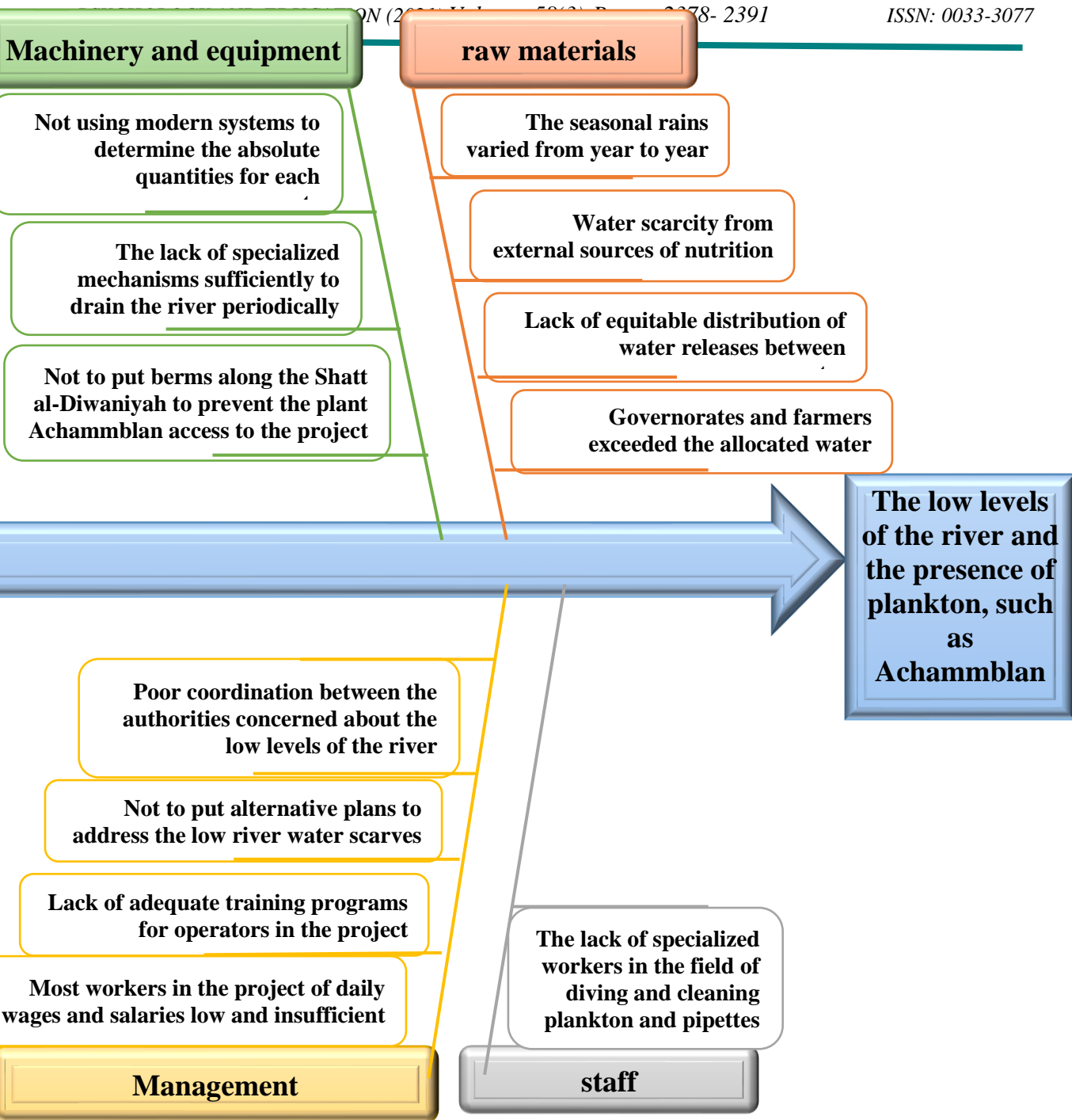


Figure (3) shows the cause and effect diagram for the problem of raw water and plankton decline

It is clear to us from Figure (3) that the main causes of the problem are the low level of raw water and plankton, such as the Achamblan plant, that the first reason is related to the raw materials, which is raw water, from which there are sub-causes, which are (the variation of seasonal rains from one year to another, the scarcity of water from external sources of nutrition, Lack of equitable distribution of water releases between governorates, bypassing governorates and farmers over the allocated quotas) as the lack of rain and poor nutrition from external sources due to the various crises results in unequal release of water rations due to the low level of storage in the upper lakes (strategic storage) in addition to the abuses by

Governorates located on the river basin, as for the second reason, which is the machinery and equipment, from which the sub-reasons are branched (the failure to use modern systems to determine the absolute quantities of each governorate, the lack of specialized mechanisms sufficiently to clean the river periodically to prevent the emergence of plankton such as the Achamblan plant, failure to place the barriers on The length of the Diwaniyah River to prevent the Achamblan plant from reaching the project) as the irregularity of the regular maintenance of the purification and dredging of the river caused the rivers to be buried and the lack of water quantities They are paid through dams and regulators, in



addition to the frequent impact of the scarcity of the sums allocated due to the political, security and financial crises in the country. The third reason was the working individuals, from which the sub-causes are branched out (the absence of specialized workers in the field of diving and cleaning plankton on pipettes to withdraw raw water). Workers in a painstaking way to treat and clean raw water pipettes due to the lack of specialized divers in this field, while the fourth reason was management procedures, from which the sub-causes are branched (poor coordination between the concerned authorities about the low levels of the river, failure to develop alternative plans to deal with

the decline of river water scarves, The lack of training programs for the project's operators, most of the workers in the project are of daily wages and their salaries are low and insufficient) as there is no control and treatment center for problems between the Diwaniyah Water Directorate and the relevant authorities about raw water levels, in addition to the lack of training and development programs for workers due to the lack of specializations.

Figure (4) shows the use of the Cascade Cause Analysis tool (5 Why) in identifying the root causes of the second major problem, which is (frequent power outages).

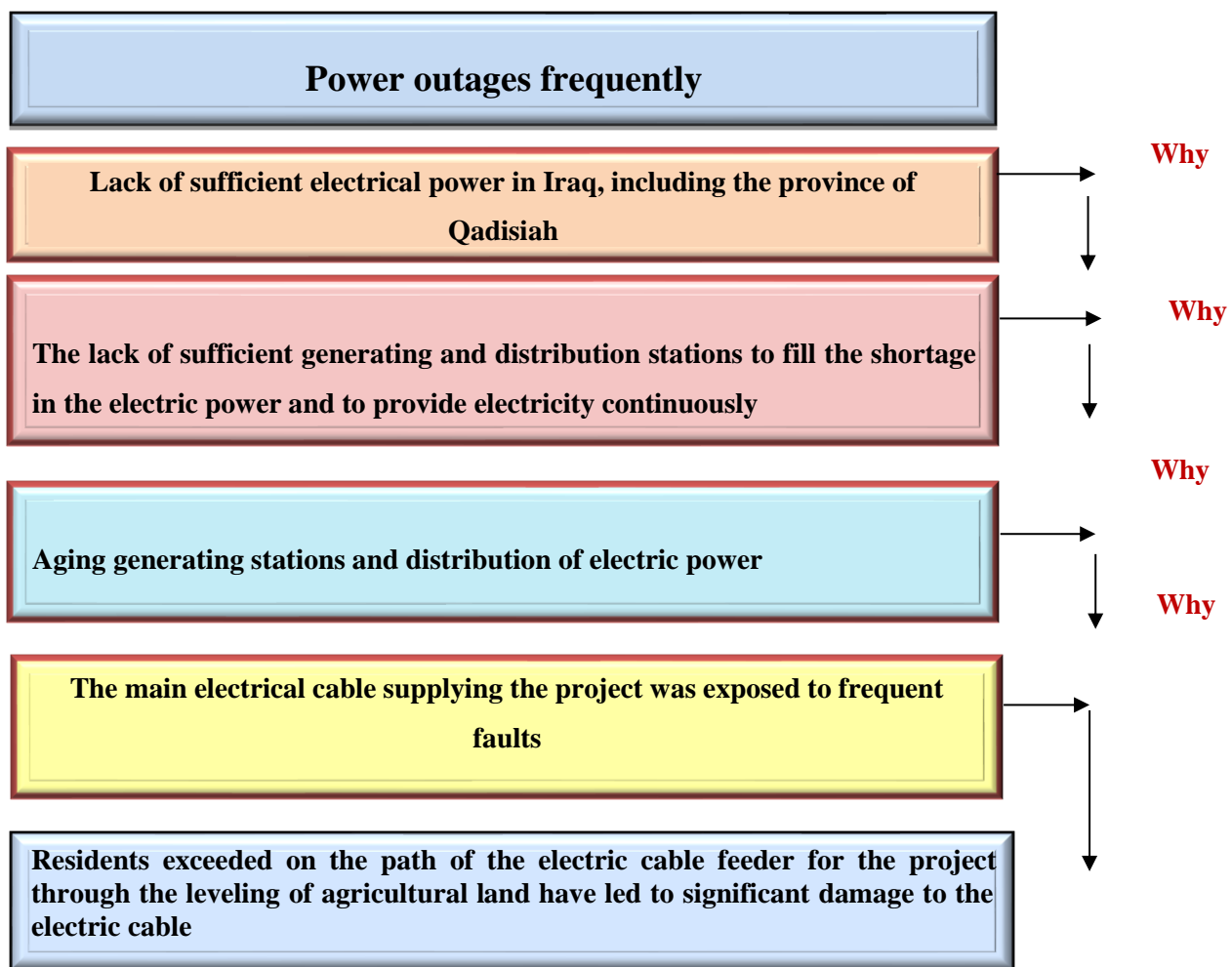


Figure (4)

**Problem frequent power outages**

It is clear to us from Figure (4) that the deficiency in the supply of electric current in Iraq in general and in the province of Qadisiyah in particular affects the continuous supply of electrical current for the modern Diwaniyah water project, in addition to the fact that the generating stations for electrical and distribution energy are old, and sufficient new stations have not been established to ensure continuous distribution. Without problems, in addition to the repeated faults of the only main cable feeding the

project, as it extends the extension of the cable underground and in the event of any defect in it there is difficulty in locating it except by using modern mechanisms that determine the location exclusively, which is present in the Diwaniyah Electricity Directorate exclusively, which causes an increase in the allotted time To deal with the defect in the electric cable, in addition to the people bypassing the cable path by the people by using heavy machinery in drilling, which causes the cutting of the feeding cable in some cases.

**d- Improvement:**

At this stage, the focus is on developing solutions and solutions to the problems that were raised in the previous stage, as some solutions were found related to the work of the Diwanayah Water Directorate and others outside its powers, provided that the Directorate adopts the official overtures in this regard

- 1- A general strategy for the management of water and its distribution in all major rivers with the participation of experts, consultants, universities and relevant ministries to develop a mechanism for distribution in a fair and find adequate alternatives in the seasons of health, especially in the summer, and to benefit from international experiences in water management.
- 2- Rehabilitation of organizations specialized in water distribution, introduction of modern technologies, and electronic equipment in dams and systems to ensure distribution according to the established plans and not to exceed the quotas allocated to each governorate.
- 3- The formation of a unified central control center that receives data for the absolute quantities of electronic numbers of dams and regulators in which it checks the quantities in the event of an increase or decrease in quantities, and thus the control is central to how it is subject to jurisprudence as is currently in force.
- 4- Developing public awareness programs, with the help of civil society organizations and the media, to clarify the picture for citizens and higher authorities about the importance of river water and not to waste or throw waste and pollutants in it, and clarify the concerns that may occur if water projects stop working completely.
- 5- Develop a plan of cooperation between the relevant ministries in the area of rivers and beneficiary ministries to develop a mechanism for continuous cooperation throughout the year.
- 6- Dredging and continuous cleaning of the Shat Al-Diwanayah Basin, as it is the only source for feeding the project with raw water and using modern specialized mechanisms to get rid of plankton and Al- Achamblan.
- 7- Putting iron grids on the drawing stations in the modern Diwanayah water project in a regular manner that ensures easy cleaning and returning them to the river smoothly and quickly.
- 8- Establishing training and development programs for workers in the modern Diwanayah water project, since most of them have new contracts after completing the project and do not have high experience in this field, in addition to the need to transfer them to permanent staff to ensure the continuity of the project.
- 9- The introduction of modern technologies in the management and operation of the project and the placing

of electronic tools at the entrance of the water to the drawing station to know the quantities entering the project correctly and to know the actual need of raw water to operate the project, in addition to placing electronic equipment on the payment lines to know the efficiency of the work of the propulsion pumps.

- 10- Provide adequate quantities of fuel and oils for generators to ensure the project's work in the event of a power outage.
- 11- The work of periodic maintenance of the generators to ensure the actual work time needed, in addition to assigning specialized workers to run and follow-up generators work on a daily basis to avoid any emergency.
- 12- Construction of large dams for the purpose of storing water and generating electric power, in addition to implementing modern irrigation networks, in addition to maintaining existing irrigation projects.
- 13- The provision of adequate financial allocations to work to extend an electric cable reserve for the project.

**e- Control:**

At this stage, the performance of the operations is monitored and measured and the inspection stations are set up for each stage, that is, after each operation, through continuous monitoring of all stages of the filtering and sterilization operations within the project and carrying out examination and inspection to reach high quality and reduce deviations in work.

- 1- carry out corrective actions that ensure the application of improvements in phases by the Directorate to get to achieve the satisfaction of citizens to provide safe drinking water.
- 2- Designing monitoring programs for the main rivers and tributaries to monitor the quantities of incoming and outgoing water for each governorate.
- 3- The use of GIS, one of modern techniques to preserve surface water and provide the required water needs for each region.
- 4- Coordination between the Ministry of the Interior and the Ministry of Water Resources in order to monitor abuses and the application of deterrent sanctions, especially during the season of water scarcity.
- 5- Coordination with the Ministry of Electricity for the need to speed up the completion of faults in the event that they obtain the electrical cable feeding the project.

The third topic: conclusions and recommendations:

First: the conclusions:

- 1- The only water source that feeds the modern

Diwanayah water project is the Diwanayah River, which is the main artery for the city in providing raw water for the work of projects in the water sector, and that any imbalance in the water levels in the river or the presence of impurities and plankton in it or any environmental pollution affects the service Greatly provided.

2- The treatment system in the work of the project is a physical treatment of water, i.e. (filtering and sterilization), where the impurities and plankton in the raw water are removed and then sterilized with dissolved chlorine to eliminate viruses and bacteria in it.

3- The application of the (DMAIC) methodology in the modern Diwanayah water project has an effective role in improving the service process provided by the Diwanayah Water Directorate, by defining the problem present in the project and clarifying the problems most influencing the emergence of the main problem in the measurement stage and identifying it, and then working to find out the root causes The main and subsidiary problems of the main problem in the analysis stage, then proposing the required improvements, developing solutions in the improvement stage, and establishing an effective control system to follow up the progress of the proposed improvements and measure the performance of the processes on an ongoing basis.

4- The problem of (the low level of raw water and the presence of plankton such as the Achammblan plant and the lack of alternative plans) represented the biggest problem at this stage, where the Pareto scheme was used to determine the relative importance of the problems and the percentage of the problem reached (42%), and by combining it with the second problem (frequent power outages) which achieve the highest percentage of problems (74%), where an impact and outcome plan was then used, which is an important tool in analyzing and clarifying the main and subsidiary causes in the emergence of the first problem and it was found that the lack of real coordination in the distribution of river water between governorates In addition to not using modern methods to control the water quotas allocated to each governorate centrally, the variation in rainfall, the lack of specialized mechanisms in dredging and cleaning the river, and the continuous encroachments on the river basin by farmers are all problems that affect the decline of raw water levels, and thus affect the process of producing good water For drinking, then the successive analysis tool (5 why) was used to analyze the most important diagnosed causes that have a major impact on the modern Diwanayah water project and to find out the roots and causes of these causes It was found that the decrease in the electrical capacity in Iraq and the obsolescence of the generating and transforming stations in addition to the exposure of the feeder cable to frequent maintenance affect the number of

working hours of the project.

Second: Recommendations:

1- The use of modern methods and mechanisms in the operation of the project, which allow wide control and control over all the project facilities, from withdrawing raw water to pumping potable water to the pipelines.

2- Developing emergency plans to confront the decline in the water level of the river and in coordination with the Ministry of Water Resources to develop solutions and treatments and indicate the quantities and levels that must be provided for the continuation of the water service, and the higher authorities inform the risks in the event that the water projects stop serving.

3- The necessity of placing iron grates at the beginning of the draft constructor in the project to prevent the Achammblan plant from reaching the draft suckers.

4- attention tests laboratory for raw water and periodically and continuous data recording regularly to work the required studies on the quality of water of the river and put tables for the project amounts to be added to the filter material and sterilization thoroughly for water production with high quality and in conformity with international standards and fit for human consumption.

5- We recommend the Diwanayah Water Directorate to apply the (DMAIC) methodology in all stages of production, which works to solve problems, diagnose them and put appropriate treatments for them, and thus lead to higher levels of quality and achieve the satisfaction of the beneficiaries of the service.

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**Appendix (1)**

<i>Put a sign ( *) in front of the phrase that represents the greatest impact on the emergence of the problem in the distribution of drinking water in each of the following areas according to your personal opinion</i>		
<b>Raw water field (river) and filter project</b>		
<b>1</b>	<i>The low level of water in the river and the plankton in it, such as the shingle plant, and the failure to develop alternative treatment plans when needed</i>	
<b>2</b>	<b>Frequent power outages and lack of supplies of fuel and oils to operate generators</b>	
<b>3</b>	<b>Lack of experience of project personnel and lack of training and motivation provided to them</b>	
<b>4</b>	<b>Lack of interest in maintaining and maintaining the equipment, devices, mechanical and electrical parts and pumps in the project.</b>	
<b>5</b>	<b>Non-use of computer systems (automation) in the operation of the project operations</b>	
<b>6</b>	<b>Weak oversight in the project</b>	