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COLLEGE OF ENGINEERING

A SIMULATION AND OPTIMIZATION APPROACHES FOR WORKLOAD ANALYSIS AND MANPOWER PLANNING

BY

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ABSTRACT

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In today's world, occupational stress is identified as a major health issue within most organizations. The reason the spotlight has been focused on occupational stress in recent years is that it can have a negative impact on employee's health and life. For this reason, this thesis focuses on the effects of workload on employees in the workplace, as well as the process of work distribution among employees. This thesis also studies the impact of major organizational restructure where the number of employees dropped by 30% and examines the impact of such a drop in the number of employees on the workload distribution. A survey is designed for the purpose of this thesis to gain knowledge on the employees' perspective on their own workload and how it can affect their lives. The survey also covers a section designed for supervisors where they can provide input on the process of work distribution among employees. Moreover, a simulation model is created to model the process of project lifecycle within the organization, to understand the behavior of the system, and gain insights on the utilization of manpower resources. Finally, a mathematical model is designed to optimize the number of employees and maximize profits by optimizing the current available manpower resources. The results of the simulation and the survey showed that the workload is not evenly distributed among the employees, causing delays in the project delivery.

DEDICATION

This thesis is dedicated to my family and friends who have always believed in me, stood by my side, encouraged me, and inspired me throughout my journey…

ACKNOWLEDGMENTS

“I would like to acknowledge the support of Dr. Mohamed Haouari and Dr. Deepti Muley for providing support to achieve some objectives of this thesis”.

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1.1 Introduction

In today's modern world, occupational stress is considered one of the major health issues in different organizations. The overall experience of the workplace can have negative impacts on the employees ranging from short-term health issues (e.g., fatigue or headache) to long-term health issues (e.g., cardiovascular disease). From an organizational aspect, high occupational stress can affect the employee's behavior at the workplace which can affect the operation of the organization (Spector, 2002).

The employee is able to be productive up to a certain point of workload, beyond that point, the productivity of the employee decreases drastically as seen in Figure 1. Working for long hours with a high workload can have a negative impact on the employee's health as well as their performance, leading to an increase in mistakes in the work done (Hartline, 2018).

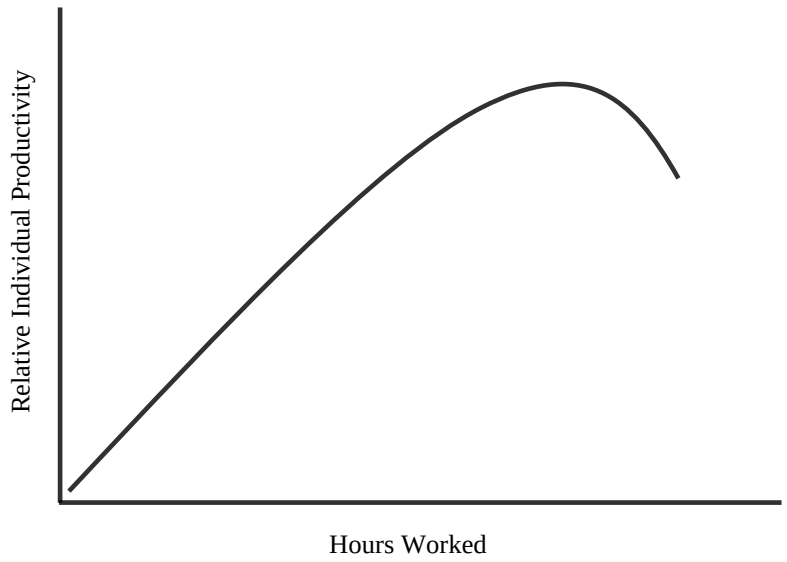


Figure 1. Hours worked vs productivity of the employee

Job satisfaction is considered one of the main reasons affecting job retention. It is defined as any combination of psychological, physiological, and environmental

circumstances that cause a person truthfully to say I am satisfied with my job (Hoppock, 1935).

Heavy occupational stresses are directly related to the level of job satisfaction of the employee. The greater the occupational stresses, the lower the level of job satisfaction for the employee. Lower job satisfaction can lead to lower productivity and lower job retention which will negatively affect the organization both operationally and financially (Burke, 1976).

One of the ways to combat low job satisfaction levels, the organization must ensure that their employee's needs are satisfied, this includes good working conditions and environment, high-performance rewards and recognition, and flexibility of the organization with their employees (Raziq and Maulabakhsh, 2015). Another important way that increases job satisfaction between employees is by providing the training required to properly perform their tasks (Gazioglu et al., 2006).

Many organizations nowadays are facing major issues with human resources planning. Poor human resources planning normally leads to deadlines not being met, project delays, poor communication, as well as other issues that result in a drop in productivity and efficiency of the organization's operation. One of the major forms of poor human resources planning is when the workload is not distributed correctly. It can be noticed that some positions within an organization are overwhelmed with work, while other positions are hardly doing any work.

This is a case of workload being ineffectively distributed among the available employees. In order for the organization to develop its productivity, the organization must ensure a balance in human resources planning (Mayasari and Gustomo, 2014).

Some organizations have started to notice the effects of uneven workload distribution among their employees and aimed to resolve the issue. Using workload

analysis methods to analyze the workload on employees and better distribute the workload, thus, increasing the efficiency and productivity of the organization (Budiman and Putranto, 2015).

1.2 Background

The subject of this thesis is an engineering and projects directorate within an organization in Qatar. The engineering and projects directorate is responsible for all projects and engineering activities for the organization, with a centralized engineering department that includes experienced engineers in all engineering disciplines. While the projects department is responsible to carry out the projects for construction and commissioning stages. The directorate also contains other supporting departments.

In 2015, the entire organization underwent a full restructure, the main objective of this restructure is to reduce the operational cost of the organization by terminating 30% of employees. Such a drastic decrease in the number of employees has led to multiple issues arising including improper workload distribution.

1.3 Novelty

The novelty of this thesis is utilizing optimization and simulation tools for the project lifecycle. Since simulation software are generally not designed for simulating projects and their different stages, some assumptions have been considered.

In addition, this thesis will provide a mathematical model that will help better distribute the workload between employees. This will help the management to have a balanced workload distribution which will lead to higher productivity and efficiency of the organization. Even with changes in the current number of employees, the mathematical model will be able to distribute the workload in the cases of firing and hiring employees. Such a tool will save the management time and effort for human resources planning.

1.4 Problem Statement

In the 2015 organization restructure of employees, the main objective of the restructure was to cut down the operational costs of the organization. The restructure included termination of 30% of all employees, closing down, and opening new departments, sections, and programs to fit the new decreased number of employees while trying to minimize the effects on the overall operation of the organization.

The new organization restructure consisted only of 70% of the employees (before 2015). This decrease in employees must have affected the operation of some parts of the organization if not all. It has been reported in one particular department that since the restructure, management has been facing issues with manpower utilization, it is difficult to efficiently utilize all manpower to its maximum ability, which led to a drop in efficiency and productivity of the department. The department wants to maximize the utilization of the current manpower to increase efficiency and productivity.

The decrease in the efficiency of the department is costly, projects are delayed, operational and business goals are not met. Was the restructure in 2015 cost-effective? Did it save the overall cost of operation? Or did it end up costing more due to an insufficient number of employees and unoptimized manpower utilization?

1.5 Objectives

The objectives that this study aims to achieve are:

1. Compare the overall status of the organization before and after the 2015 restructure using the survey results and data from the organization.
2. Utilize simulation to understand the behavior of the system and find gaps, bottlenecks, and issues.

3. Optimize the current employee workload to maximize efficiency using a mathematical model.
4. Provide recommendations to better distribute the workload and maximize efficiency and productivity and achieve employee satisfaction and business goals.

1.6 Thesis Layout

As shown in the thesis Flow Diagram below, the thesis consists of six chapters. Chapter one provides an overview of the thesis. The purpose of chapter one is to present an introduction and background on the chosen topic as well as why this topic was chosen. Chapter one also highlights the novelty of the thesis, the problem statement, and the objectives to be achieved by the end of this thesis. Chapter two includes a comprehensive literature review about workload stress and its effects, workload analysis, workload analysis applications, workload distribution, and optimization. Chapter three includes the process description and the simulation. In this chapter, the project lifecycle process is described in detail using process maps, and the simulation model created using Anylogic software is presented as well as the results obtained from the simulation model. Chapter four covers the survey designed for this thesis. In this chapter, the process of designing the survey is described and discussed to present the reasons for the question selection. Chapter four also covers the results of the survey analyzed from the received responses. Chapter five includes the optimization mathematical model created for the purpose of this thesis, it also includes the discussion of the mathematical model and its results. Finally, chapter six covers the conclusions of the thesis, the recommendations provided for the given problem, and the future works that describe how this topic can be further developed and studied for further development of the topic.

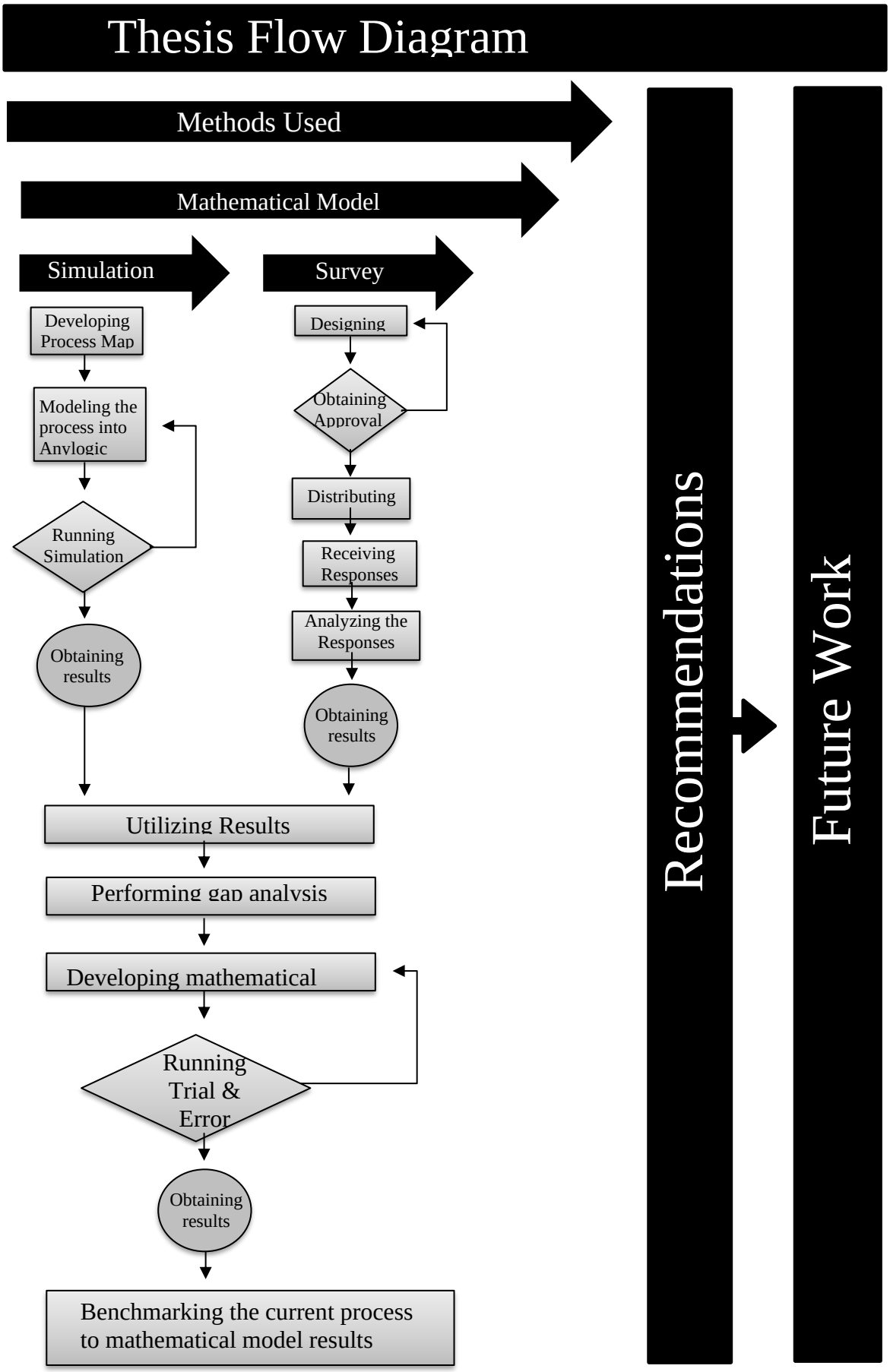


Figure 2. Thesis methods flow

CHAPTER 2: LITERATURE REVIEW

2.1 Workload stress and its effects

For a long time, the workload has been difficult to define, the topic is well known and well researched, but the concept of workload stays ambiguous. One of the definitions given is: “Mental workload is a hypothetical construct that describes the extent to which the cognitive resources required to perform a task have been actively engaged by the operator” (Gopher, 1986). Another simpler definition is: “the amount of work done by a particular person” (Bennaars, 1994). Workload has been long associated with stress, having high workloads at work is a main cause of stresses we experience daily. The times we live in have been called the “age of anxiety and stress”. Stress as a word has been difficult to define, many definitions in the literature included distress, inability to cope, and feelings of fatigue (Qureshi et al., 2013). Physical stress, emotional stress, and social stress are the main categories of stress that affect people every day. Physical stress is caused by intense physical activities, trauma, environmental pollution, etc. Emotional stress is caused by resentment, anger, fear, etc. Finally, social stress is caused by lack of social support, loss of employment, loss of loved ones, etc. All forms of stress take its toll on the human body, being stressed for long periods of time does have its health consequences, stress is found to be a cause of headache, asthma, fatigue, nausea, anxiety, and heart problems, to name a few (Antoni et al., 1993). Stress is considered a critical reason for employee dissatisfaction and high turnover rates within an organization. Organizations nowadays are focusing their efforts on stress management since stress can affect employees’ performance and ultimately affects the goals and objectives of the organization. Stress is caused by many different sources including lack of acceptance of completed work, lack of support from

administration, lack of monetary awards, and personal issues. Another major aspect causing stress within employees is misfit with the organization. If the organization does not care about its employees, the employee in return will not care about the organization and will hate working for this organization causing their stress levels to increase (Imtiaz and Ahmad, 2009). It has been proven that stress in the workplace is very costly to organizations. According to the International Labor Organization (ILO), inefficiencies caused by occupational stress cost countries up to 10 percent of their Gross National Product (GNP). As an example, industries in The United States spend around $69 billion each year on stress-related costs (Ongori and Agolla, 2008).

2.2 Workload analysis

Workload analysis is a technique used to identify the actual requirements of human resources in quantity and quality with regard to organizational goals and strategies. (Stanton et al., 2004). The purpose of using workload analysis is to determine the optimal human resources requirements for the long and short term. It is also used to identify the human resources training requirements and manage the sufficient number of employees in the work system in place to enhance productivity (Hanjani and Singgih, 2019). The aim of Workload analysis is to identify the suitable burden that can be assigned to a single worker and then the optimal number of workers can be obtained (Adawiyah and Sukmawati 2016). To validate the workload analysis, quantitative and qualitative workload measurements should be utilized. Measurements of workload are classified into three classifications: physiological measure, subjective measure, and performance-based measure.

The physiological measurement states that an increase in physical response from the body is caused by an increase in mental demand. The physiological

measurement is concerned with measuring the physical responses of the human body. It measures all the changes in the body while doing a specific task, such as brain activity, speech measures, eye activity, respiratory activity, and cardiac activity (Moray, 1979). Subjective measurement of workload level has a different approach, it measures the amount of workload felt by a person using scales or rankings. Subjective measures utilize question-answer responses for changing workload levels, with two types of scales used for subjective measures which are: unidimensional scale and multidimensional scales. Finally, performance-based measurement focuses on the individual's performance changes with more and more tasks, it measures if the individual's performance will drop with more tasks (Miller, 2001).

One of the most commonly used methods in measuring the physical workloads is the Full-Time Equivalent (FTE). In this method, the number of manpower needed to achieve certain jobs is determined by the workload time (Sari et al. 2018). FTE is utilized to adjust the workload on the workers to accomplish their highest level of performance. FTE is a way of comparing the task completion time of distinct jobs to the effective work time available (Zainal and Ramadhanti 2019). The main output obtained from this method is the optimal number of workers needed to achieve the job. FTE can provide information on the workers, allocation based on the findings obtained from measuring the direct work time using the Stopwatch (Indrawati et al. 2018). According to the State Employment Agency guidebook, the work is considered to be underloaded when the value of FTE is less than one and overloaded if the value of FTE is more than 1.28, while the workload is determined to be normal if the value of FTE between 1- 1.28 (Suryoputro 2018).

National Aeronautics and Space Administration – Task Load Index (NASA-TLX) is a widely used assessment tool for measuring subjective mental workload

(MWL). NASA-TLX is a multi-dimensional scale used to measure the performance of workers in six scales which include mental, physical, temporal demands in addition to effort, performance, and frustration level. It has been applied in various fields including nuclear, civil aviation, and power plants. NASA-TLX method has been utilized for purposes that are beyond its initial application (Bommer and Fendley, 2018). It is "being used as a benchmark against which the efficacies of other measures, theories or models are judged" (Hart, 2006). Based on previous studies, the scores obtained using NASA-TLX subscales have shown that the variability of the overall workload has been kept to a minimum in comparison to unidimensional ratings and it has the ability to provide information about workload sources (Rachmuddin et at., 2021).

2.3 Workload analysis applications

Workload analysis is a crucial tool in the field of workload studies, it has been utilized in many fields, applications, and for different purposes. (Wojciechowski, 2004) was able to utilize workload analysis in studying the workloads associated with driving a ground vehicle for the U.S. Army Research Laboratory, where the results showed that if additional tasks were attempted by the driver while operating the ground vehicle, the performance will start to degrade. Another application of workload analysis, (Mayasari and Gustomo, 2014) have utilized workload analysis to CV.SASWACO PERDANA, a textile company based in Indonesia, where the workload was poorly distributed among the employees which was causing delays, low efficiency and productivity, and organizational goals not being met. After utilizing the workload analysis, jobs that were either overloaded or underloaded were identified. Finally, the workload was distributed evenly among the employees which increased the efficiency and productivity of the organization. Workload analysis has been also utilized in the health sector, (Napirah

and Sulistiani, 2015) have used this tool to find the optimal number of required staff in the laboratory at Rumah Sakit Umum Anutapura hospital. The results of the research showed that the laboratory unit is still in need of more people and needs to improve the manpower planning to maximize the efficiency of the laboratory. Workload analysis is not only used for employees in organizations, (Wang et al. 2004) have utilized workload analysis in software and programming. The tool was used to understand the expected workload on file systems that will help in the design of high-performance parallel file systems. The available technologies allowed the application of such a tool within the complex world of programming, to be able to examine and analyze the workload on a parallel computing environment of file systems, to allow for such systems to be designed.

2.4 Workload distribution

In order for organizations to maximize their productivity and efficiency, a properly distributed workload is a must. Many of the companies facing low efficiency and productivity overlook the distribution of workload among employees. PT. Batuwangi Putera Sejahtera is a company involved in mining and milling limestone in Indonesia, has been facing low productivity levels for years, while investigating, it was found that the main reason is uneven workload distribution. After utilizing workload analysis, underloaded and overloaded jobs were known and resolved by evenly distributing the workload among the available staff, as well as hiring more employees since the number of employees was not sufficient to begin with (Budiman and Putranto, 2015).

2.5 Simulation

Simulation is defined as the mimicry of a real-life system or process over time. It includes the producing artificial history of the system, and to observe how the system behaves within the simulation to help understand the real-life system. Simulation is

powerful problem-solving tool utilized to solve real-life problems, used to analyze the behavior of different systems within a controlled environment that allows to safely exam “what if” scenarios for the real system. One of the advantages of simulation is diagnose problems, with real-life complex problems, there are many variables acting on the system with many interactions, a simulation could narrow down the root causes for the issues within the system (Banks, 1999).

Simulation has many applications in many fields of life, it can be utilized to simulate a bank process where the customers arrive to the tellers at intervals, the customer will spend some time with the teller then proceeds to exit. Within the simulation model can be modified to change the number of tellers to test how the system will react, it may increase or decrease the wait time. Another application for simulation is for air traffic control, in order to ensure an efficient system for all the aircrafts taking off and landing in the airport to minimize delays of flights a simulation model can be developed to test the system before applying it to the airport, and to anticipate any issues or delays that could occur and try to eliminate them (Banks, 1998). Simulation has been utilized in the groundwater resources field as well, with the global population increasing rapidly, the need for groundwater in drastically increasing. Scientists have come up with multiple solutions to solve the issue of the increased demand of groundwater, and in order to test these solutions to select the best and most efficient solution, simulation is utilized. The different solutions can be modeled and simulated with the inputs being the number of the global population each year, the methods of extracting the groundwater, and other data, and the simulation model will help to find the best solution to be applied to such a major problem (Singh, 2014).

2.6 Optimization

Optimization is a powerful tool used for solving large complex problems. One of the main advantages of optimization is that it can provide precise and accurate solutions to real-life complex problems. Optimization was initially evolved to provide generic solutions, and was mainly divided into two main categories, linear and nonlinear programming problems. Early generations of programming problems were based on continuous variables, many classes of design and assignment problems required dealing with both integer and continuous variables which lead to mixed integer linear and nonlinear programming problems. Resource degradation is a global problem that will continually increase (Singh and Panda, 2013). Optimal utilization of these resources is important in order to ensure they will last for generations (Davies and Simonovic, 2011). Taking advantage of optimization techniques, this powerful tool is used for solving large complex problems that can provide precise and accurate solutions. The main benefit of optimization is the ability to obtain the best results among the alternative solutions (Singh, 2012). Within the field of workload distribution, to the best of our knowledge, the topic has not been addressed previously. Researchers were able to apply optimization in many fields, (Santos et al., 2015) were able to utilize optimization techniques in irrigation management. Sugarcane requires large amounts of water and energy to grow, if these resources are overused, farmers can be wasting a lot of these resources. Optimization was utilized in this field to properly and optimally use water and energy to reduce costs and ensure the sugarcane is getting enough water to grow (Wang et al. 2004). Another interesting use of optimization is in the field of groundwater management. Groundwater is scarce in some locations of the world; sustainable use of groundwater is crucial in these areas because many industries are dependent on the use of this water. Optimization was utilized to enable researchers in

determining groundwater wells and spacing between wells, time, and frequency of using the wells, and technologies used (Wilderer, 2010). Almost all coastal aquifers around the world are facing a major problem, seawater intrusion is a process that occurs to coastal aquifers that are connected to oceans or seas, where seawater unintentionally makes its way to the freshwater aquifers. This problem causes the freshwater to become salty water, which makes the freshwater unusable for its intended use. As the demand for freshwater increases around the water, the seawater intrusion issue needs to be controlled, in order to do so, optimization models are utilized to obtain the optimal feasible pumping rates in coastal aquifers to protect the freshwater from seawater intrusion and be able to meet the global demand for freshwater (Sreekanth and Datta, 2010).

CHAPTER 3: PROCESS DESCRIPTION AND SIMULATION

3.1 Project Stages

Projects carried out by the organization are considered profit-generating projects. These projects follow strict procedures and guidelines. There are five project stages: Project Initiation, Feasibility Study, Concept Optimization, Engineering Design, and Implementation and Completion. Along with these stages, there are also project gates. There are six project gates from gate zero to gate five, and they are normally between the project stages. Project gates are used as approval points, where deliverables need to be approved by concerned parties prior to proceeding to the next project stage. Figure 2. Shows the process flow for the project through all the stages and gates, as well as the resources required for each stage. For each project, there are three different types of resources required for completion, these resources are Discipline Engineers, who are required to develop the technical work such as engineering activities, drawings, and calculations. The second type of resource is Project Managers, who are responsible for managing the project stages. Finally, the last type of resource is supporting departments personnel, who are responsible for developing project supporting documents such as cost estimates, project schedule, etc. As shown in Figure 2. The number of employees from each resource type required for each stage is included within the stage, i.e., stage one requires 5 Discipline Engineers, 1 Project manager, and 5 Supporting Departments Personnel. The number of available employees for each resource type is shown at the bottom of the same figure. There are 175 discipline engineers available, 25 project managers available, and 60 supporting departments personnel. Within the organization, the projects are categorized into five categories, 1 through 5. The categorization is based on the complexity and cost of each project, category 1 projects are the highest cost and most complex, while category 5 projects

are the lowest cost and least complex projects. For categories 4 and 5, stages 2 and 3 can be skipped, this is due to the simplicity and lower financial risk on the organization, and to reduce the project time by reducing the number of stages and gates the projects need to get through. The rest of the projects categorized as categories 1 through 3 will go through all the stages and gates. During each gate, a project can be rejected due to errors or incompletion of some of the stage deliverables, in gate 0, the project can be rejected if, after the review of the project justification, it will be decided to discard the project, while for the other gates, the project can be rejected to go back for modifications to be implemented and resubmitted for approval. Figure 3. Shows the process flow for the project through the stages and gates.

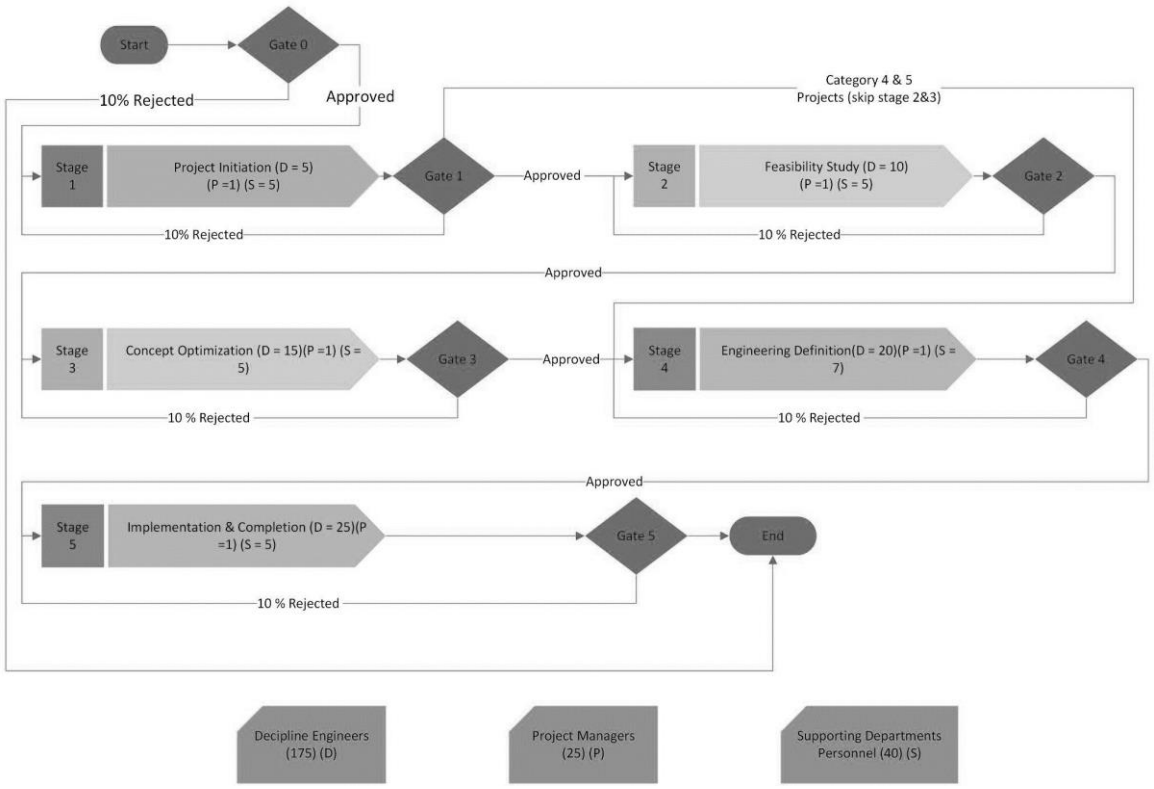


Figure 3: Process flow for the project through all the stages and gates

Each project undertaken by the organization is unique from every aspect, for the issue it is solving, the cost, the duration, the complexity, the team required to complete

the project, the location, etc. For the project duration, it depends on the duration of each stage, and the duration of each stage will depend on the deliverables to be delivered, and how long it takes the team to complete a stage. Table 1 shows the duration range for each stage. Since each project is different, the duration of each stage is shown as a triangular distribution with a minimum, mode, and maximum duration for each stage based on historical data gathered from the organization. In the proposed simulation model that will be described in the next chapter, triangular distribution is found to be the best fit for estimating the duration of a stage, and it best describes the real probability of the duration range.

Table 1: Required duration for each stage

Stage	Minimum Duration (Days)	Mode Duration (Days)	Maximum Duration (Days)
Stage 1	15	25	30
Stage 2	30	60	100
Stage 3	30	60	100
Stage 4	60	130	300
Stage 5	60	300	1000

Stage one (Project Initiation)

To further describe each project stage, Project Initiation is the first stage of each project, and it included studying whether the project should be carried out or discarded, is the project going to profit the organization in the short or long term or not at all, what is the purpose of the project and who is it benefiting, what are the considerations for the project, how long will the project take for completion, and how much will it cost the organization. Figure 4. Shows the process map followed for stage one of any project.

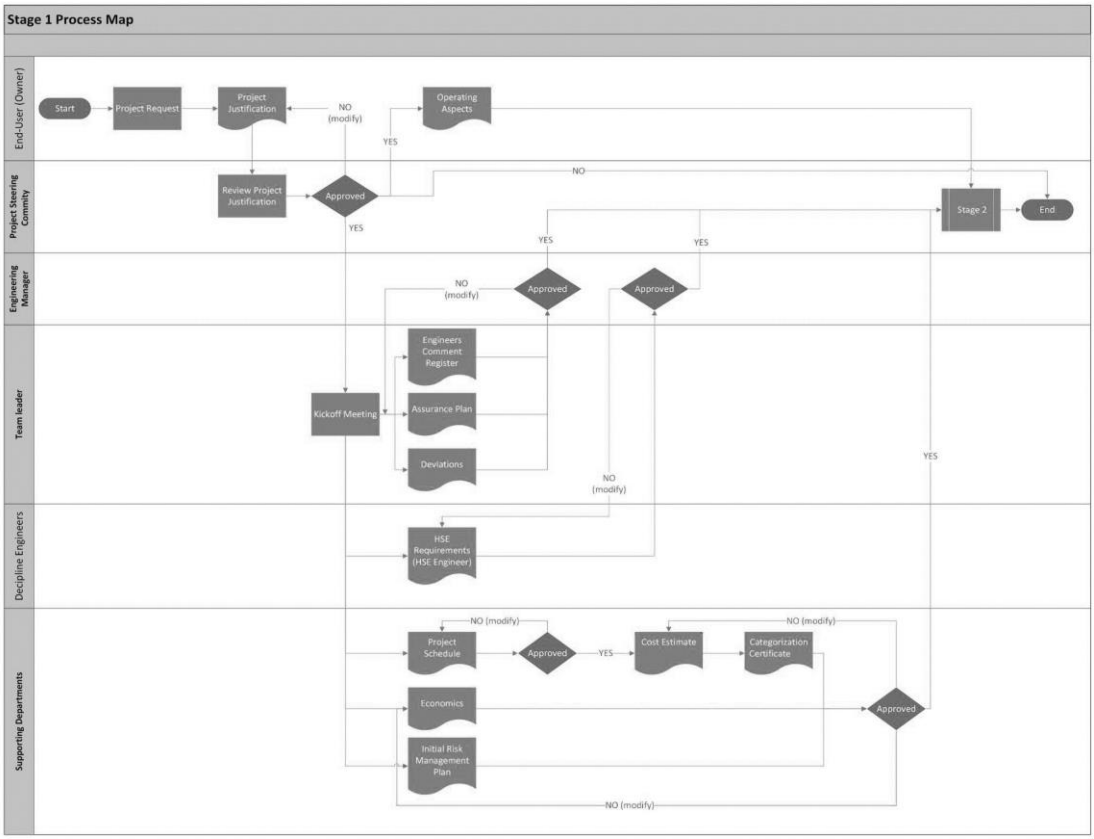


Figure 4: Stage one process map

The process maps demonstrate in detail the role of each member of the project team and the documents they are responsible for. This stage starts with a request of the project to be initiated by the end-user (owner of the project); the end-user must provide a strong project justification explaining why this project is needed. The project justification is then reviewed by the project's steering committee which will decide whether this project is important enough to be carried out, this approval is gate zero. If approved, the project manager will host a kickoff meeting for the entire team to discuss the project and ensure all the team members are on the same page. The team will then start to develop the stage deliverables in parallel, where the end-user will develop the operating aspects of the project, the team project manager will develop the engineers' comment register, assurance plan, and the deviation procedures. The discipline

engineers will develop the health, safety, and environmental (HSE) requirements, and the supporting departments are responsible for developing the project schedule, economics of the project, and initial risk management plan. After completing the deliverables, the project team must obtain approvals from engineering managers and supporting departments managers. After the approval is obtained for the supporting departments' documents, the cost estimate and the categorization certificate are then developed. Finally, final approval is obtained which is gate one for all the deliverables, and the project moves to stage two.

Stage two (Feasibility Study)

The feasibility study is the second stage of each project. In this stage, the project is studied carefully. It is decided whether the project is feasible to carry out or not. All aspects of the project are studied to validate its feasibility, this includes the schedule of the project, the cost of the project, the resources required, the project requirements, and all other technical aspects. This is to ensure that the project schedule, cost, etc. are realistic and can be accomplished. Figure 5. Shows the process map followed for stage two of any project.

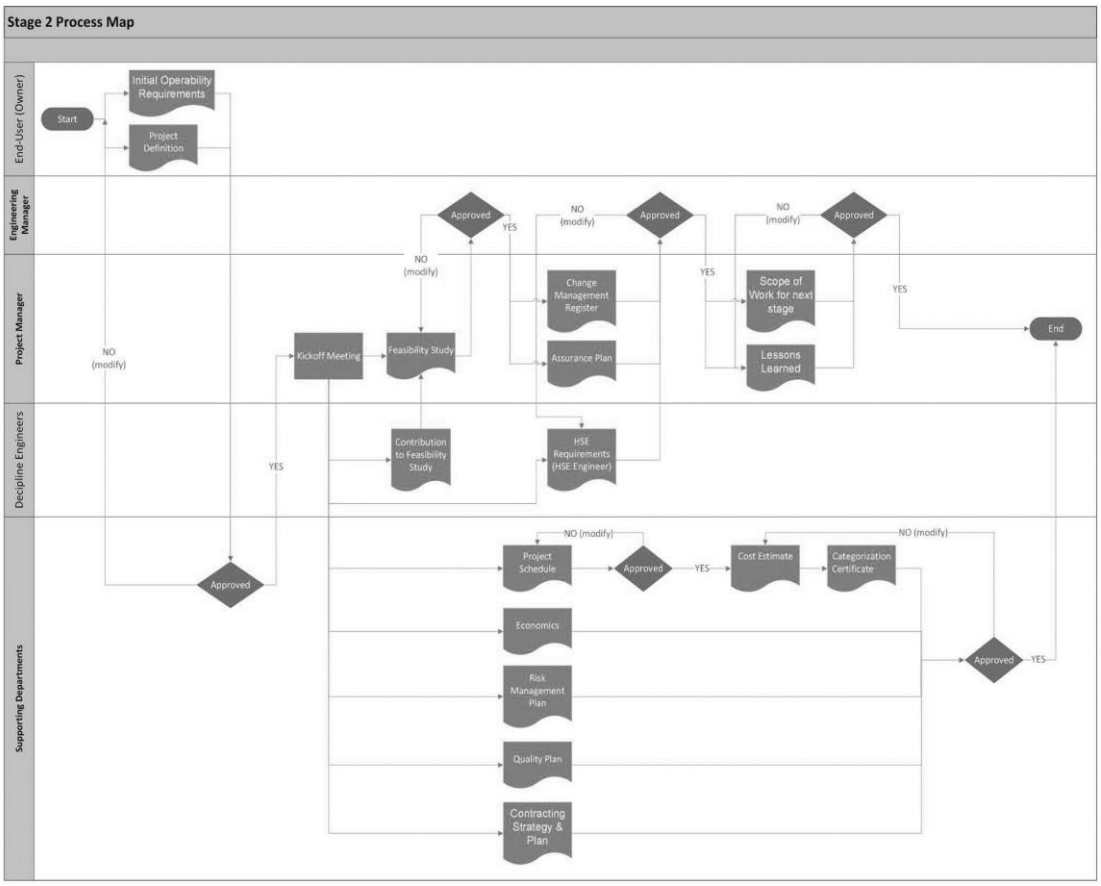


Figure 5: Stage two process map

The second stage of any project starts with the end-user developing and providing the project team with a project definition as well as initial operability requirements. If both documents are approved, the project manager will host a stage kickoff meeting to inform all the team on updates for the project and to discuss what needs to be done for this stage. The project manager will then start to develop the feasibility study with the support of the discipline engineers, the discipline engineers will also develop a refined version of the HSE requirements. Parallelly, the supporting departments will develop refined versions of the project schedule, the economics of the project, risk management plan, quality plan, and contracting strategy and plan. After approvals for the completed deliverables, the project manager will develop a change request register, assurance plan, scope of work for the next stage, and lessons learned. While the supporting departments will develop a refined cost estimate and a new

categorization certificate. After the final approval, which is gate two, the project moves to the next stage.

Stage three (Concept Optimization)

Concept optimization is the third stage of projects carried out by the organization. This stage focuses on further improving the project details of the project to ensure it is the best alternative. Optimizing the concept includes looking at other alternatives and comparing them together and selecting the optimal alternative for all project aspects (cost, schedule, etc.). Figure 6. Shows the process map followed for stage three of any project.

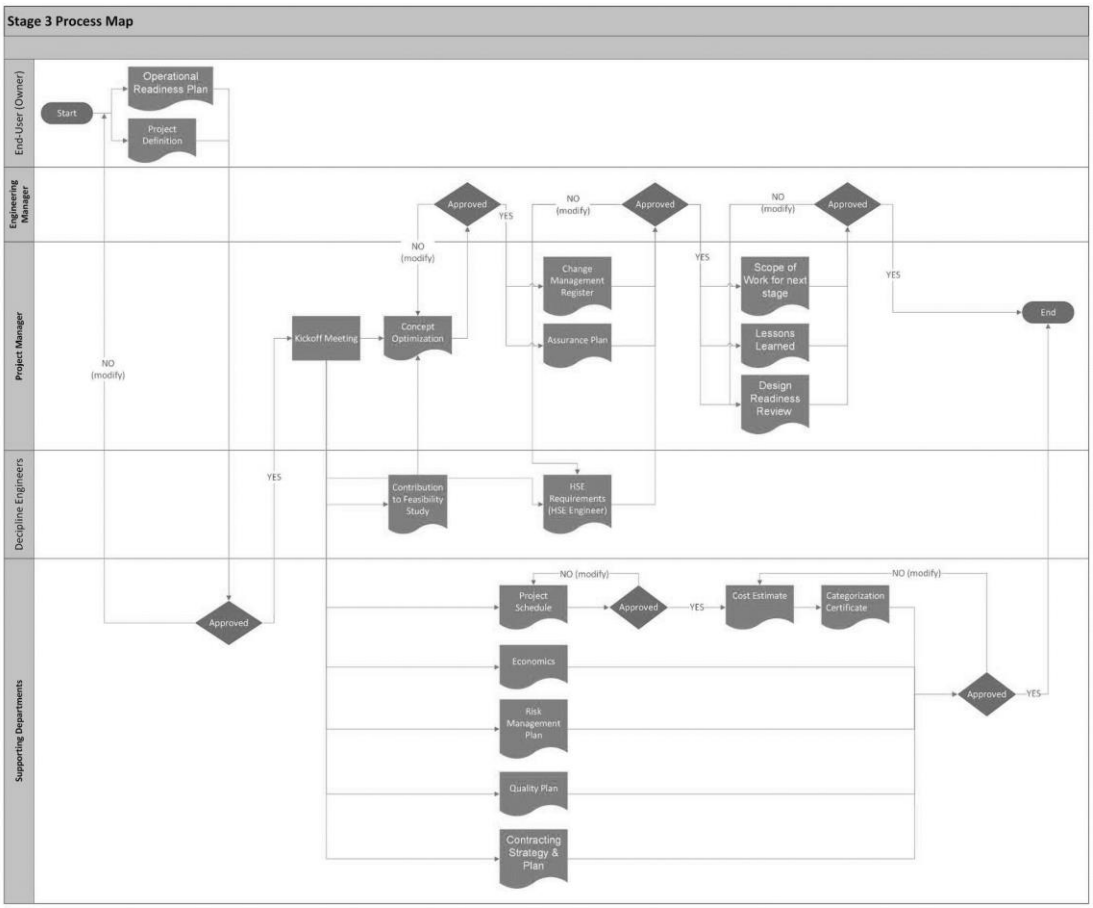


Figure 6: Stage three process map

Similar to stage two, stage three starts with the end-user developing an operational readiness plan and a further refined project definition. The project manager, similar to other stages, will host a stage kickoff meeting to discuss the stage with the project team, then will start to develop the concept optimization document with the support of the discipline engineers. In this stage, the project manager is responsible to manage the change management register document, to develop an assurance plan for the stage, to develop the scope of work for the next stage, to document the lessons learned, and to develop the design readiness review document. The discipline engineers will develop the HSE requirements for the stages, while the supporting document will develop a refined version of the project schedule, economics of the project, risk management plan, quality plan, contracting strategy and plan, cost estimate, and a new categorization certificate. After obtaining the final approval, which is gate three, the project will move to the next stage.

Stage four (Engineering Design)

Engineering design is the fourth stage for a project. It is where all the engineering work is done. In this stage, concerned technical teams from the organization study the project in great detail and develop the required technical deliverables (calculations, engineering design, architectural design, drawings, pipeline routing, etc.). This stage is crucial since it requires all the technical deliverables to be very accurate and precise because it will be used for the actual implementation and commissioning of the project. Figure 7. Shows the process map followed for stage four of any project.

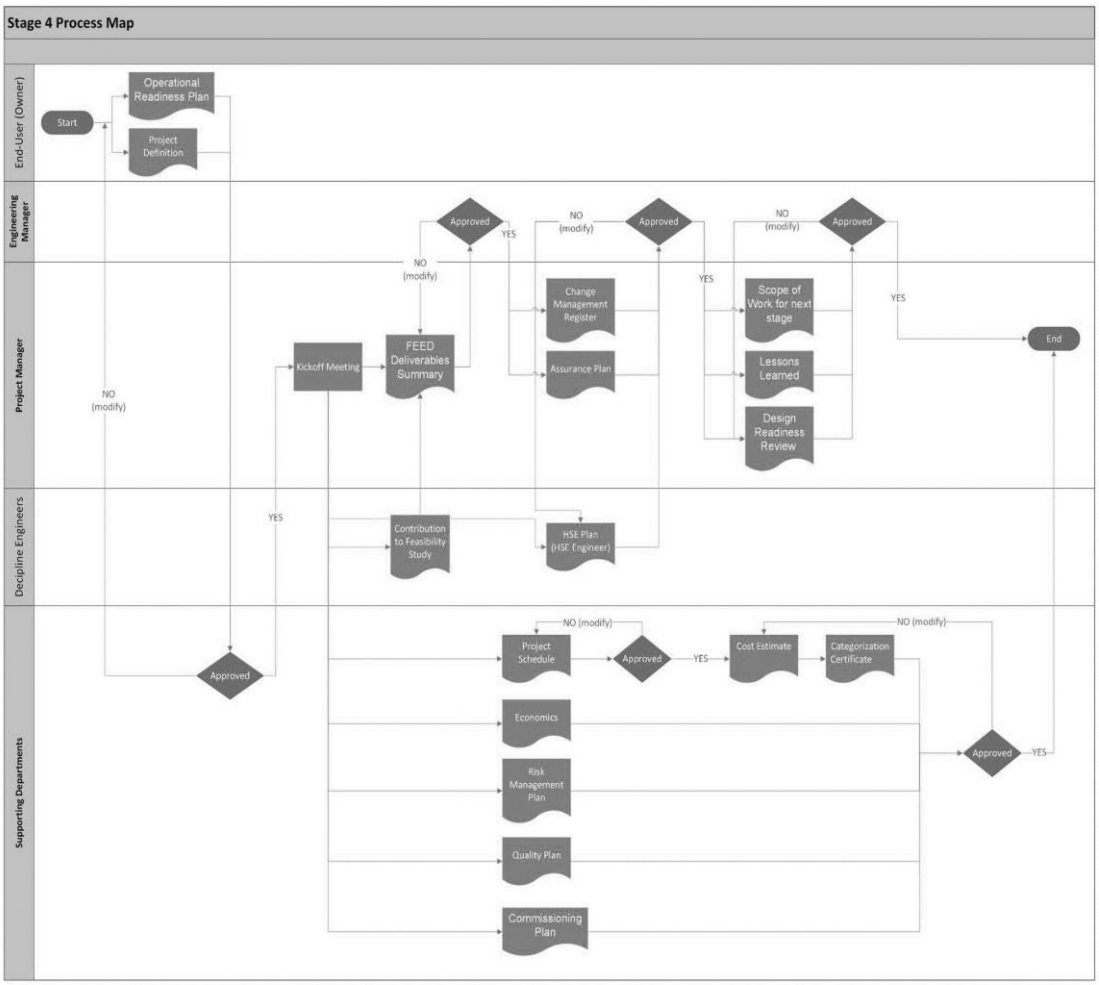


Figure 7: Stage four process map

The first three steps of stage four are similar to stage three. The project manager then will develop the Engineering Design deliverables summary with the support of the discipline engineers, the project manager will then manage the change management register, develop the assurance plan for the stage, develop the scope of work for the next stage, document the lessons learned, and the design readiness review. The discipline engineers will develop the HSE requirements for the stage, while the supporting departments will develop refined versions of the project schedule, economics of the project, risk management plan, quality plan, commissioning plan, cost estimate, and a new categorization certificate. After the final approval is obtained which is gate four, the project proceeds to the final stage.

Stage five (Implementation and Completion)

The final stage of a project is the Implementation and completion stage. In this stage, the physical deliverables are delivered by an outsourced contractor. As a part of cost reduction philosophy, the organization outsources the implementation and completion activities to a contractor while closely monitoring and supervising the activities on site. This stage includes the construction of structures, routing pipelines, building rigs or plants, etc. Figure 8. Shows the process map followed for stage five of any project.

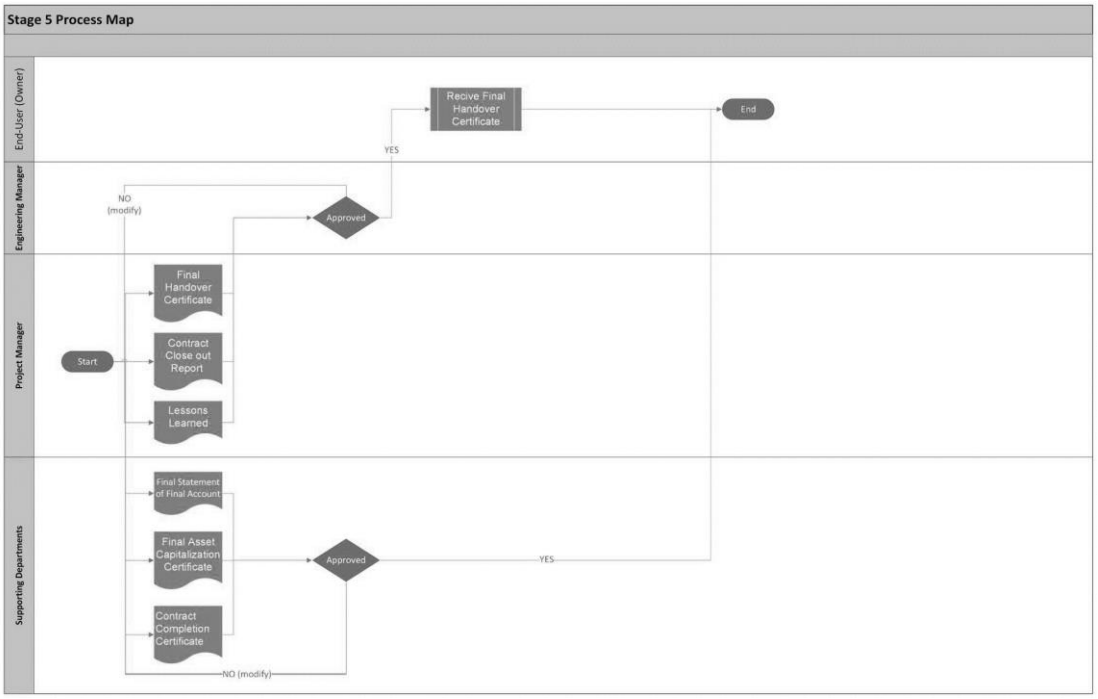


Figure 8: Stage five process map

The final stage of the project starts with the project manager developing the final handover certificate, contract close-out report, and lessons learned. While the supporting departments will develop the final statement of the final account, final asset capitalization certificate, and contract completion certificate. After the final approval

which is gate 5 is obtained, the project is then handed to the end-user and finally closed off.

3.2 Project Gates

Project gates are placed between all the project stages, they are intended as approval checkpoints for upper management to decide whether the project should proceed to the next stage, or some changes must be done first. For each of the project gates there is a set of deliverables to be completed by the project team, many of which are included in multiple gates, this is to allow the project team to refine these deliverables as the project progresses (i.e., cost estimate in the first gate is 50% accurate, wherein fifth gate it should be 90% accurate). The project gates placed within the process are shown in Figure 2.

Gate zero

Gate zero is the very first gate for any project. This gate is placed before the actual initiation of the project, and it is placed to evaluate each project by upper management. Projects normally come from end-users requiring projects to be carried out. Not all projects are accepted and carried out, a board of managers will have the say on whether the project should be undergone or should be discarded. The board of managers evaluates each project from many aspects such as: cost, requirements of the project, justification of project, schedule, needs of the organization, available budget, etc. If the project is accepted by the board of managers, it moves to the first stage which is the initiation stage.

Gate one

Gate one is the second gate of any project, and it is placed after the successful completion of stage one (Project Initiation). This gate has a list of deliverables to be

completed by the project team in order for the project to move to the next stage. The deliverables for gate one are:

1. Project Justification
2. Economics
3. Initial Risk Management Plan
4. Project Schedule
5. Cost Estimate
6. Operating Aspects
7. HSE Requirements
8. Initial Categorization Certificate
9. Assurance Plan
10. Engineers Comment Register
11. Deviations

The project team is required to complete all the deliverables within schedule to apply for upper management's approval. If upper management approves all the deliverables submitted, the project moves to stage two, if the approval is not obtained, the project team shall apply changes provided by upper management feedback on to the deliverables and resubmit the deliverables for approval again.

Gate two

Gate two is the third gate for each project. Even though it has a different deliverables list, some of the deliverables are the same as gate one. The repeated deliverables are listed because they are still required for this gate, but with more refining and greater details. The deliverables for gate two are:

1. Project Definition
2. Economics
3. Feasibility Study
4. Risk Management Plan
5. Project Schedule
6. Cost Estimate
7. Change Management Register
8. HSE Requirements
9. Quality Plan
10. Contracting Strategy & Plan
11. Initial Operability Requirements
12. Categorization Certificate
13. Scope of Work for next stage
14. Lessons Learned
15. Assurance Plan

If all the deliverables of gate two are approved by upper management, the project will proceed to the next stage (Concept Optimization), if any of the deliverables is not approved, the project team will need to implement the required changes provided by upper management and resubmit the deliverables.

Gate three

Gate three is the fourth gate of any project. This gate has very similar deliverables requirements as gate two, this is because stage two (feasibility study) and gate three (concept optimization) are slightly similar in function. Both stages two and

three are focused on studying the project and the methodology to be adopted to carry out the project. The deliverables for gate three are:

1. Project Definition
2. Economics
3. Concept Optimization
4. Risk Management Plan
5. Project Schedule
6. Cost Estimate
7. Change Management Register
8. HSE Requirements
9. Quality Plan
10. Contracting Strategy & Plan
11. Initial Operability Requirements
12. Categorization Certificate
13. Design Readiness Review
14. Scope of Work for next stage
15. Lessons Learned
16. Assurance Plan

Gate four

Gate four is the fifth gate for any project. This gate is positioned after the fourth stage (Engineering Design) the deliverables for this gate require more approvals than other gates, this is because this gate is very crucial since it is before the project implementation stage. All the deliverables required for this gate will be used as final documents for the actual implementation of the project, thus, high accuracy is important for these documents. Documents such as drawings, plot plans, pipeline routes, electrical

requirements and plans, calculations, etc. are the main documents used for the construction and implementation of the project, any mistakes in these documents will be very costly and will delay the entire project. The deliverables for this gate are:

1. Project Definition
2. Economics
3. Engineering Design Deliverables Summary
4. Risk Management Plan
5. Project Schedule
6. Cost Estimate
7. Change Management Register
8. HSE Plan
9. Quality Plan
10. Contracting & Purchasing Strategy & Plan
11. Operational Readiness Plan
12. Categorization Certificate
13. Design Readiness Review
14. Scope of Work for next stage
15. Commissioning Plan
16. Lessons Learned

Similar to the previous gates, in order for the project to move to the next stage (Implementation and Completion), all the deliverables must be approved by upper management. If any of the submitted deliverables is not approved, the team needs to make the required changes and resubmit the deliverables for approval.

Gate five

Gate five is the final stage for all projects. This gate is positioned after the final stage of the project (Implementation and Completion), after the project is successfully delivered and completed, this final gate includes the closing of the project and project handover to the end-user. The deliverables for this gate are:

1. Final Handover Certificate
2. Statement of Final Account
3. Final Asset Capitalization Certificate
4. Contract Completion Certificate
5. Contract Close-out Report
6. Lessons Learned

After all the deliverables of gate five are approved by upper management, the project is successfully completed and officially closed. Table 2 describes the deliverables.

Table 2: Deliverables description

Deliverable	Description
Project Justification	A document explaining why the project is needed
Economics	A document evaluating the economic aspects of the project
Initial Risk Management Plan	A document addressing all risks and contingency plans
Project Schedule	A document showing in detail the project schedule

Deliverable	Description
Cost Estimate	A document calculating all costs of the project
Operating Aspects	A document explaining operation aspects related to the project
HSE Requirements	Health, safety, and environmental requirements to be considered during the project
Initial Categorization Certificate	Initial categorization of the project (category 1 to 5)
Assurance Plan	A document presenting the performance gaps of project execution
Engineers Comment Register	A spreadsheet for all engineers to submit their comments and concerns on the project
Deviations	A document describing a process to be followed in case of any deviation (design deviation, contract deviation, etc.)
Project Definition	A document explaining and describing in detail all aspects of the project
Feasibility Study	A collection of documents studying the feasibility of all aspects of the project

Deliverable	Description
Change Management Register	A spreadsheet to keep track of all changes required and implemented to the project
Quality Plan	A document providing guidance on quality management of the project
Contracting Strategy and Plan	A document stating in detail the strategy and plan for contracting with third parties
Initial Operability Requirements	A document describing the overall initial requirements for the project
Scope of Work for next stage	A document stating all the work required to be completed for the next stage of the project
Lessons Learned	A document containing the lessons learned from the project stage for future reference
Concept Optimization	A collection of documents studying the different alternatives of a project and optimizing the selected solution
Design Readiness Review	A review of different aspects of the project to ensure the project is ready for the next stage or for operation
Engineering Design Deliverables Summary	A summary of the deliverables to be delivered during the engineering design stage

Deliverable	Description
Commissioning Plan	A plan to ensure the project is ready for commissioning and to guide the commissioning process
Final Handover Certificate	Certificate handed to the end-user to receive ownership and full control of the facility
Statement of Final Account	A statement detailing all final financial accounts regarding the project
Final Asset Capitalization Certificate	A certificate for cost and value of the asset
Contract Completion Certificate	A certificate for the completion of all contracts
Contract Closeout Report	A report stating the closing and end of the project

3.3 Simulation and Anylogic Software

Simulation is a tool used to imitate the operation of real-world systems or processes over a specific time. It allows the user to understand how the system operates with the opportunity to modify, upgrade, or troubleshoot to understand how the system behaves.

To better understand and visualize the process behavior of the project lifecycle, Anylogic simulation software was utilized to further study the process in detail and to identify the gaps, bottlenecks, and issues with the system.

Anylogic is one of the most common and best multimethod simulation modeling tools available. It provides a simulation tool that can be utilized in a wide range of industries and applications. Besides the ability to visualize the process in action, discrete events, agent-based, and system dynamic simulation are a few of the methodologies supported by Anylogic.

The project stages process was modeled in Anylogic using the different modeling blocks provided by the software. Since the software is not designed for simulating project stages, some changes and improvises were implemented to tweak the software to simulate the project lifecycle. The resource block is modeled as the start of the projects, where projects arrive to be executed. The gates are modeled as decision blocks, to allow for a probability of approval and rejection to be considered. For decisions with more than two possible outcomes, the software includes a decision block with 5 different possible outcomes. Departments are modeled as resource pools; this shows the number of available resources that the software can utilize for completing the tasks. Before each stage, a seize block is used to gather the project team, this seize block contains the number of employees required from each department to complete this stage. After each stage, a release of resources is added to take the employees back to their departments (idling). One tweak that was implemented to overcome an issue where the software will utilize the resources for the entire duration of the stage, which is not the case in reality. For instance, stage 1 can take up to 30 days for completion,

but an employee may only work on this stage for 5 days. In order to implement this using the software, the days spent by an employee working on stage are separated from the entire duration for the stage. As an example, stage 1 duration is a triangular distribution of a minimum of 15 days, a mode of 25 days, and a maximum of 30 days. An employee will work on stage 1 for a duration of a triangular distribution of a minimum of 4 days, a mode of 6 days, and a maximum of 10 days. To model this in the software, the employee will be utilized (seized) for the duration of work on stage (triangular distribution of (4, 6, 10)) then will be released, then a separate delay block will be added for the remaining days of the stage (15-4, 25-6, 30-10) so the input to the software for the separate delay block will be (triangular distribution (11, 19, 20) Table 3 shows the time spent on each stage by employees. Anylogic software allows the user to control the entire environment of the process and the system, the user is able to set the duration of the system, this allows the user to gain insights on how the system behaves if it ran for different periods of time. Figure 8. Shows the project lifecycle modeled Anylogic. Comparing Figure 8. to Figure 2. It is observed that the process is modeled differently for the software to accurately simulate the real-world process. Table 3. Presents the time spent by employees on each stage of the project.

Table 3. Time spent by employee on each stage

Stage	Minimum Duration (Days)	Mode Duration (Days)	Maximum Duration (Days)
Employee Stage 1	4	6	10
Employee Stage 2	8	10	12
Employee Stage 3	8	10	14

Stage	Minimum Duration (Days)	Mode Duration (Days)	Maximum Duration (Days)
Employee Stage 4	10	20	30
Employee Stage 5	30	40	60

In order to accurately model the project lifecycle into Anylogic software, some inputs are required, constant information regarding the current situation of the process are collected directly from the organization such as number of discipline engineers, number of project managers, number of supporting department personnel. The nonconstant timing regarding the duration of the stage is shown in Table 2 and the number of projects each year is derived from historical data. The number of projects to be completed each year is taken as an average of 50 projects per year. Figure 9. Shows the project lifecycle modeled using Anylogic.

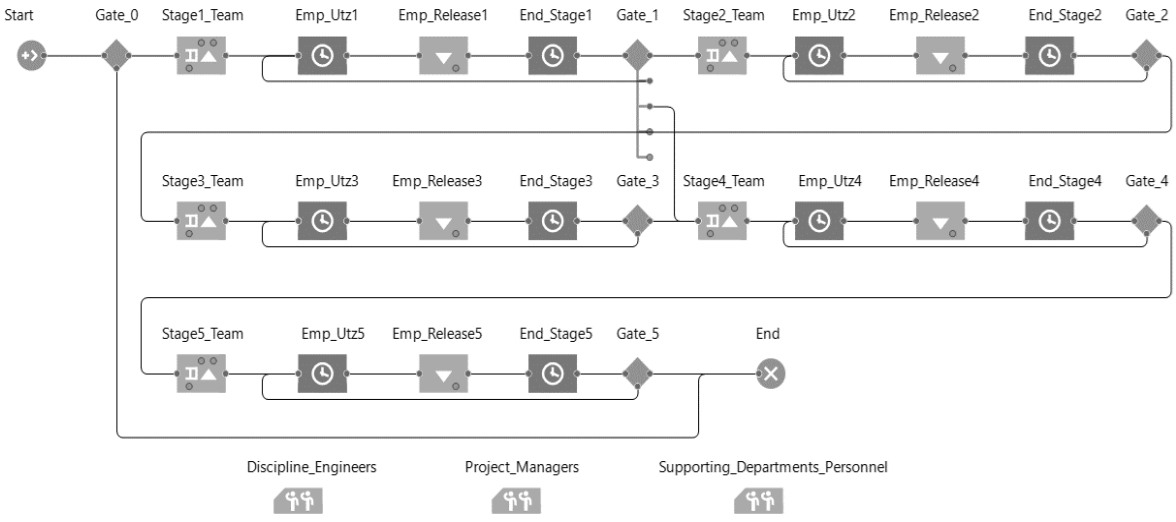
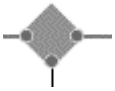
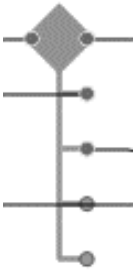
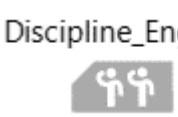


Figure 9: Project lifecycle model using Anylogic

Table 4 shows the different modeling blocks used in the modeled process along with the type of block and the description of the block to understand how the process is modeled in Anylogic software.

Table 4: Different modeling blocks used in the simulation model

Icon	Type	Description
Start 	Source	Creates agents, modeled as the start of the projects
Gate_0 	Select Output	Decision block, modeled as the approval points (gates) between stages
Stage1_Team 	Seize	Team gathering block collects the required number of employees to complete a stage
Emp_Utz1 	Delay	Process block, modeled as the amount of time spent by an employee working on a stage
Emp_Release1 	Release	Release block, modeled to return the employees back to their departments after completing the work
End_Stage1 	Delay	Process block, modeled to account for the remaining time of the process
Gate_1 	Select Output 5	Decision block with 5 outputs, modeled to for gate 1 where more than two outputs are possible

Icon	Type	Description
	Sink	End block, modeled to receive completed or discarded projects
	Resource Pool	Resources block, modeled as departments of employees

3.4 Simulation Results

The projects handled by the organization are usually larger projects that require years for completion. The simulation model is set to run for 10 years to allow time for enough projects to be completed. At the end of the simulation run, the results show the number of projects started (input), the number of projects that remained in each stage (work in progress), and the number of projects completed (output). Figure 9. shows the simulation end screen (last moment of the simulation), the input is the number to the left of each model block, the work in progress is the number above or below each model block, and the output is the number to the right of each model block. As seen in figure 9, over 10 years, 493 projects were proposed, and at gate zero, 54 of the projects were discarded, while 439 projects proceeded through the stages. Gate 1 has multiple outcome probabilities, it has the probability of deliverables to be rejected and sent back for modification and the probability of the projects categorized as category 4 or 5, where stages 2 and 3 can be skipped. It is observed that 157 projects were categorized as category 4 and 5 at gate 1. Looking at gate 5, 341 projects were completed, this shows that for after years, 341 out of 493 projects were successfully completed, which has a 69.17% success rate.

The most important information of the simulation results is the resources pool utilization. As seen in figure 9, each resource pool has a percentage at the top left of each model block. This percentage is the utilization of manpower, the utilization of discipline engineers is a high 83%, the utilization of project managers is low 37%, and the utilization of supporting departments personnel is 70%. This thesis is only focusing on the utilization of discipline engineers. Even though the utilization percentage is a high 83%, it has not reached the maximum 100% utilization, this shows that the utilization of discipline engineers is not maximized, thus the productivity is not maximized. From the survey results, the majority of discipline engineers have reported high levels of workload. With two pieces of information from the survey and the simulation, it can be concluded that even though the utilization is high at 83%, the workload distribution is poorly distributed.

Poor distribution of workload among employees means that some employees are doing much more work than others. This kind of issue can be the result of many causes, employees with more experience are more likely to have higher workloads since upper management can trust them more with completing tasks. The second cause of this issue is incompetent employees, incompetent employees are not able to handle multiple tasks at one, or they may handle tasks poorly, which results in more work to be completed by more competent employees. The third cause of this issue will be after the implementation of 2015 restructure, the process of workload distribution was not effectively modified to fit the new number of employees which results in some employees having a higher workload than others. This issue must be avoided and eliminated to ensure that the productivity of the organization is maximized to minimize the cost by maximizing utilization of available employees and thus, maximizing profits.

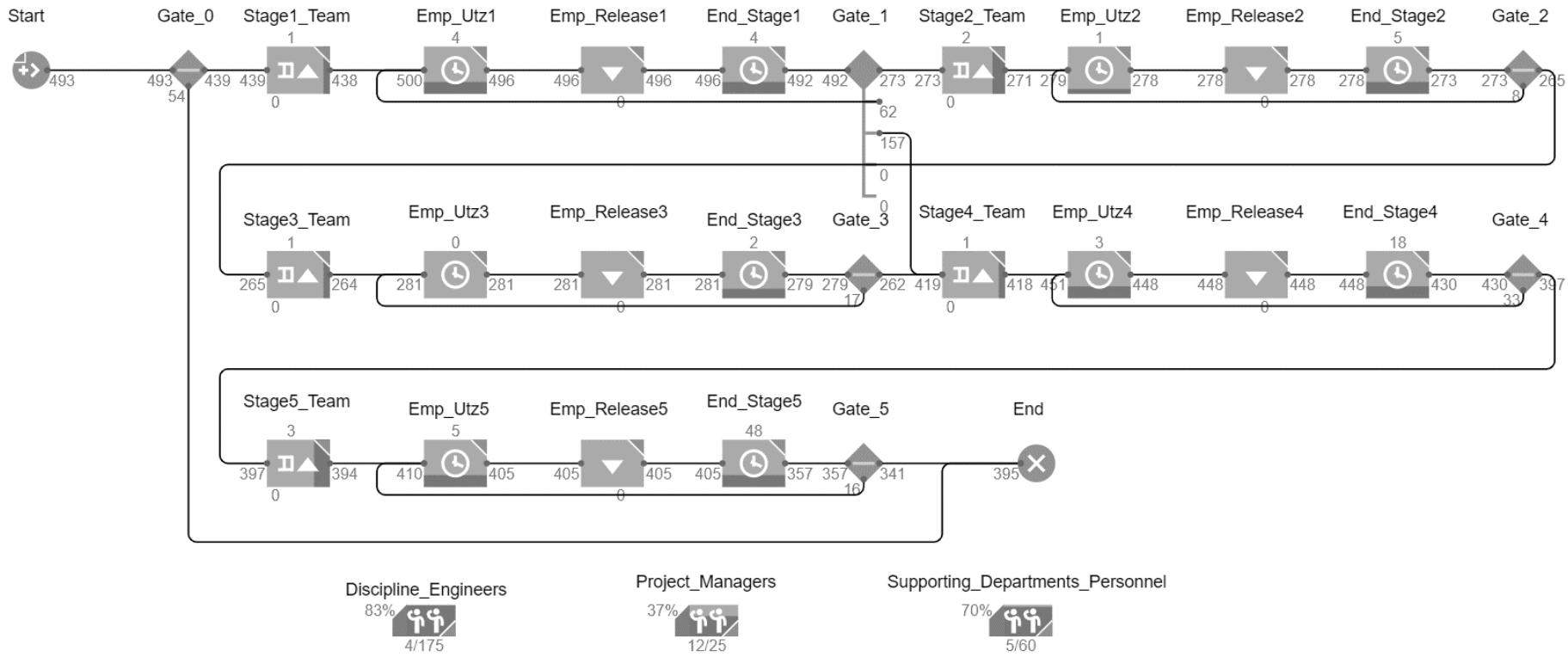


Figure 10. Simulation model results

CHAPTER 4: SURVEY AND SURVEY RESULTS

4.1 Survey

Surveys are powerful tools used heavily by researchers and organizations in many fields using a set of questions to extract specific information from a targeted group of people to gain insights and improve processes or strategies.

In order to gain insights on the workload distribution to employees as well as the effects of 2015 restructure on the employees' workload, a survey is developed to gather the needed information from the employees. The survey was divided into three parts, the first part will be distributed to all employees, the second part is designed only for supervisors, and the last part is the demographic information. The survey has multiple objectives to achieve, which are

1- Capture the employees' perspective on their workload levels
2- Understand how the workload is distributed among the employees
3- Understand how workload affects employee's life
4- Gain insight on the business productivity before and after 2015 restructure

The first part of the survey is designed for all employees (employees and supervisors) to collect information regarding the workload levels the employees are experiencing on a daily basis. It also covers questions regarding what aspects contribute to causing high workload, how high workloads affect employees and the business performance, how the workload and the workload distribution process has changed before and after the 2015 restructure, and what can be done to improve the employee's high workload levels. The second part of the survey is designed for supervisors (anyone who has subordinates). This part is concerned with the managerial aspects of workload, it covers how the workload is distributed among the employees, how 2015 restructure affected the performance of their teams if the lowered number of employees is sufficient

for the work required to be accomplished, and if they have adapted a different approach for workload distribution among the employees after 2015 restructure. Finally, the third part of the survey covers the demographic information for the respondents, to ensure the survey covered a diverse group of people within the organization with different job positions and years of experience and to gain context for the collected data.

The number of questions in the survey is kept to minimum as much as possible to ensure the respondents are able to complete the survey within 10 minutes. The survey contained 33 questions, 5 of which are demographic information questions. The information-gathering process is sensitive and shall be executed with attention to the demographic groups. Having a demographic group answer a question that is not meant for them will disrupt the results of the survey. To avoid such disruption with the results, the survey form was designed to ensure only the required demographic group is able to answer the question meant for them. Using Survey Monkey to design the survey was very helpful to utilize the different features the website offers, such as logic questions, "questions must be answered option", etc. Logic question is a useful tool provided by Survey Monkey for the design of surveys, it allows the respondents to answer a question, then depending on the answer to the question, the respondent will be directed to a specific page to continue the survey. This is used to segregate the demographic groups and ensure questions are answered by their corresponding demographic groups. The logic questions were utilized to ensure only supervisors will answer the questions in the second section of the survey. The "questions must be answered option" was utilized to ensure all the questions of the survey are answered by all respondents which will be beneficial in the results analysis phase. The survey included questions that compares some aspects of workload distribution before and after 2015 restructure, these questions were included a statement "only answer if joined before 2015" this is to

ensure only employees joined before 2015 can answer these questions since employees who have joined after 2015 will not have the right perspective to answer the question.

4.2 Survey descriptive analysis

The survey result shows that majority of employees are facing high workload levels that are affecting their lives. The survey sample size is 67 respondents, with a population of 175, response rate of 38%, completion rate of 99%, and an average duration of 8 minutes 40 seconds. A descriptive analysis of the survey is as follow:

Demographic information:

The results showed 94% of respondents are male and only 6% are female. This shows the nature of work for this department. Most jobs within the engineering department include site visits, complex engineering work, and demanding metal work. This can be some of the reasons why there is male dominance within this department. 79% of employees are above the age of 40 years old, 12% between 30-39 years old, and only 7% range from 20-29 years old. This shows most employees are older and have long years of experience within the field. 82% of respondents are engineers/architects, 8% technician/surveyor, 6% assistant manager, and 4% managers. This shows the different levels of jobs and management that participated in the survey, which is important to get information from different levels of management. 73% of respondents work onsite (office), followed by 21% working all the mentioned natures, and only 4.5% working offshore. Finally, 47% of employees have more than 25 years of experience, followed by 16% with 20-25 years of experience, followed by 13% with 15-25 years of experience, and 21% of employees with less than 15 years of experience.

Survey results:

Question 1 one of the survey aimed to find out if employees are overloaded with the workload required to be completed by them. It is also focused on whether the given workload is affecting the employee or not. In this question as shown in Figure 11. The respondents are able to choose more than one answer. As can be noted, the majority of employees have reported being overloaded with work, having too much regulatory or admin activities, and leaving work uncompleted or working after working hours. It also showed that work has a negative impact on different parts of their lives outside of work (health, personal, social). This shows that the levels of workload on employees are high.

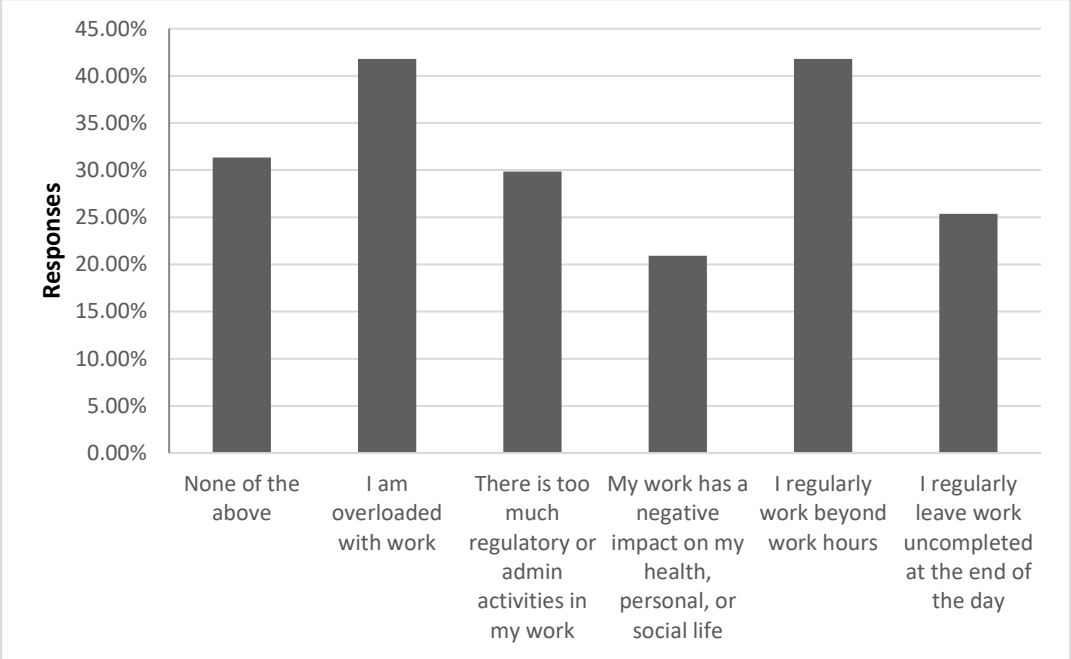


Figure 11. Employees' perception about workload level

Question 2 of the survey is aimed to determine whether the workload on employees is manageable or not. As shown in Figure 12. Around 61% of the responses range from not manageable to moderately manageable workloads. This shows that even though 39% of the employees reported a manageable workload, the majority of

employees are facing some difficulties managing their workload. Question 1 showed that employees are overloaded by work, question 2 confirms that the majority of employees are facing issues managing their workload.

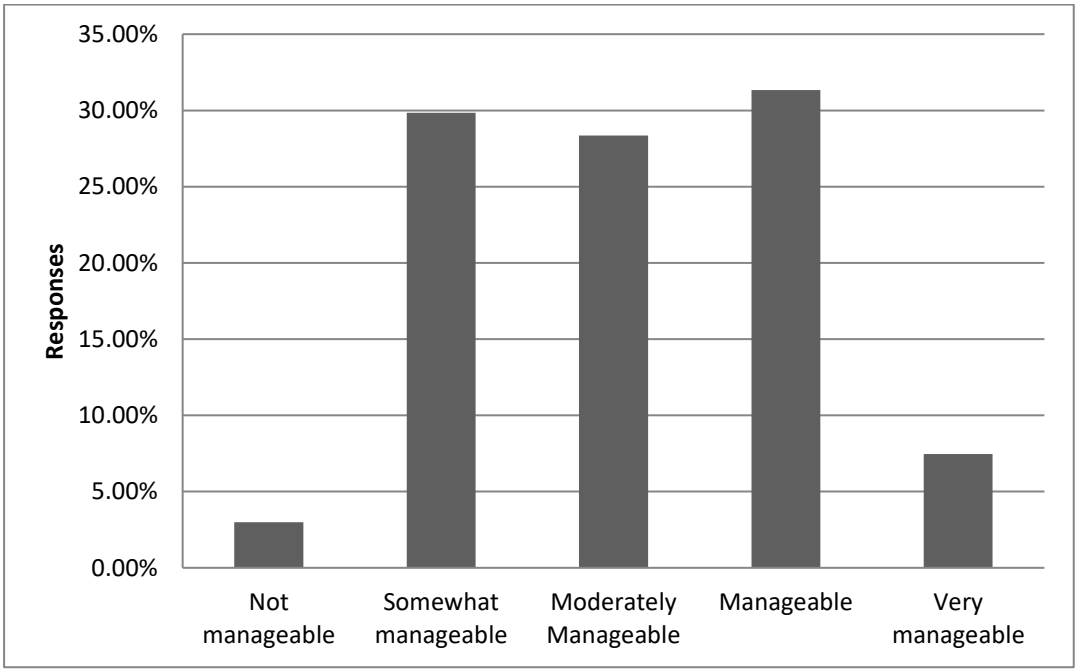


Figure 12. Manageability of workload

Question 3 of the survey is aimed to determine the number of hours put in during a week for employees to find out if employees are working overtime to be able to complete their work. Figure 13. shows that around 76% of employees spend more than 40 hours per week which gives evidence that the work required from employees cannot be completed within 40 hours. Since employees are spending their personal time (after working hours) on work, this means they are not able to cool off and relax from the workday, which contributes to feeling overloaded and overwhelmed by work.

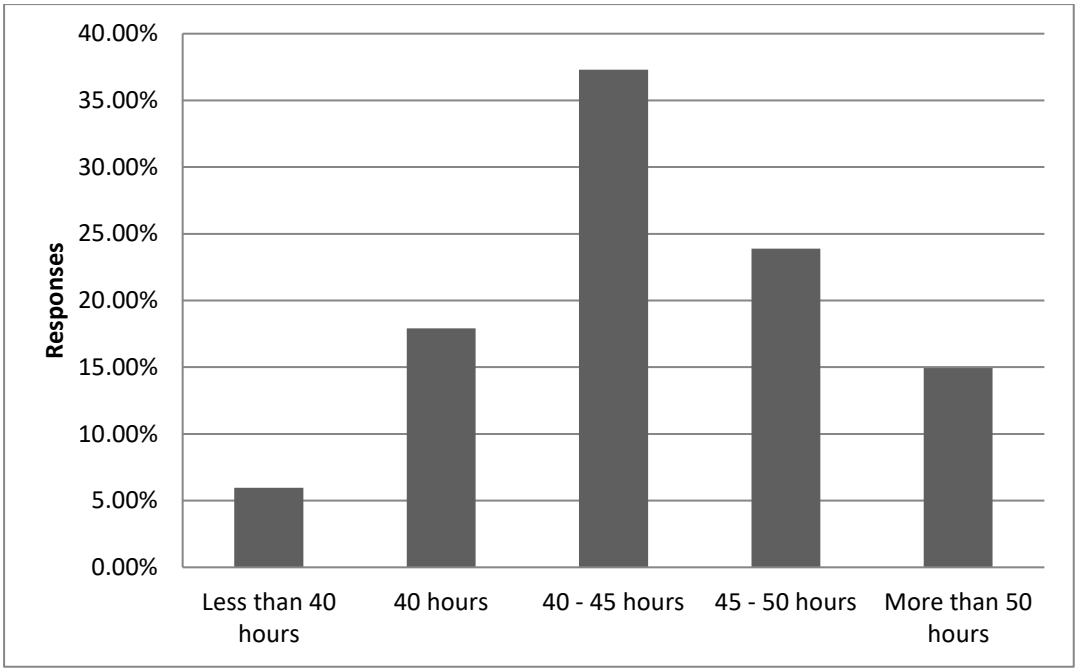


Figure 13. Working hours per week

Question 4 of the survey aims to determine how many employees work in the evening. As seen in Figure 14. About 70% of employees reported working in the evening to be able to complete required work. Working during the evening can have a negative impact on employees' productivity.

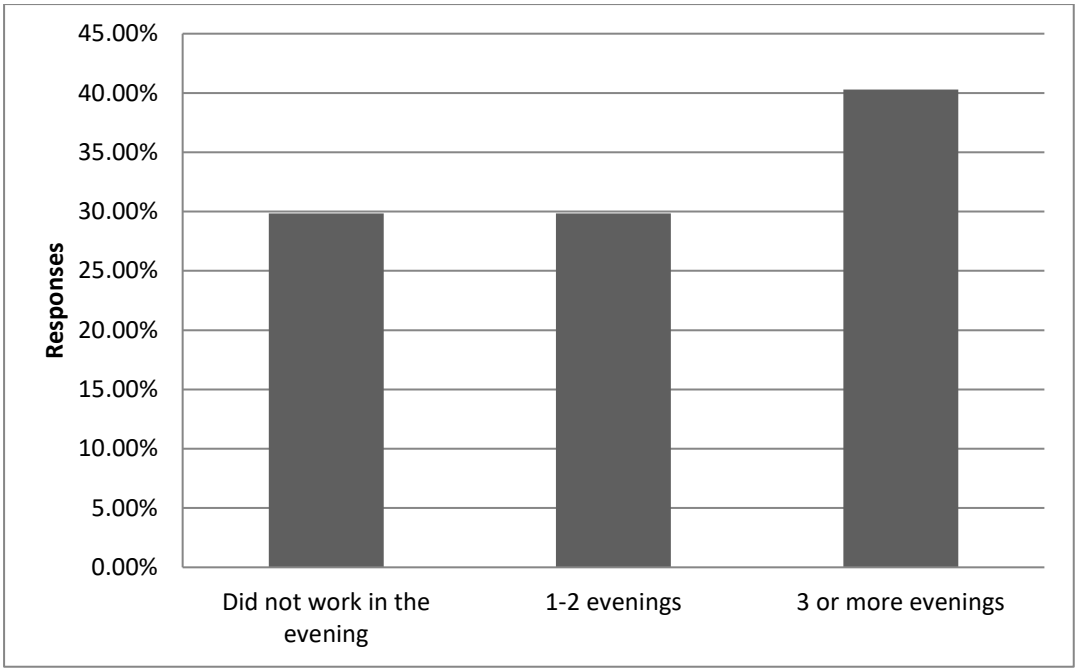


Figure 14. Work during evening per week

Question 5 of the survey is aimed to determine the number of hours worked over the weekend by employees. This is to show if the employee is using the weekend time to relax and cool off or using it to get some work done. As shown in Figure 15. About 43% of employees are spending some time on the weekend to work, while the majority of employees do not work over the weekend, 43% is a large number of employees.

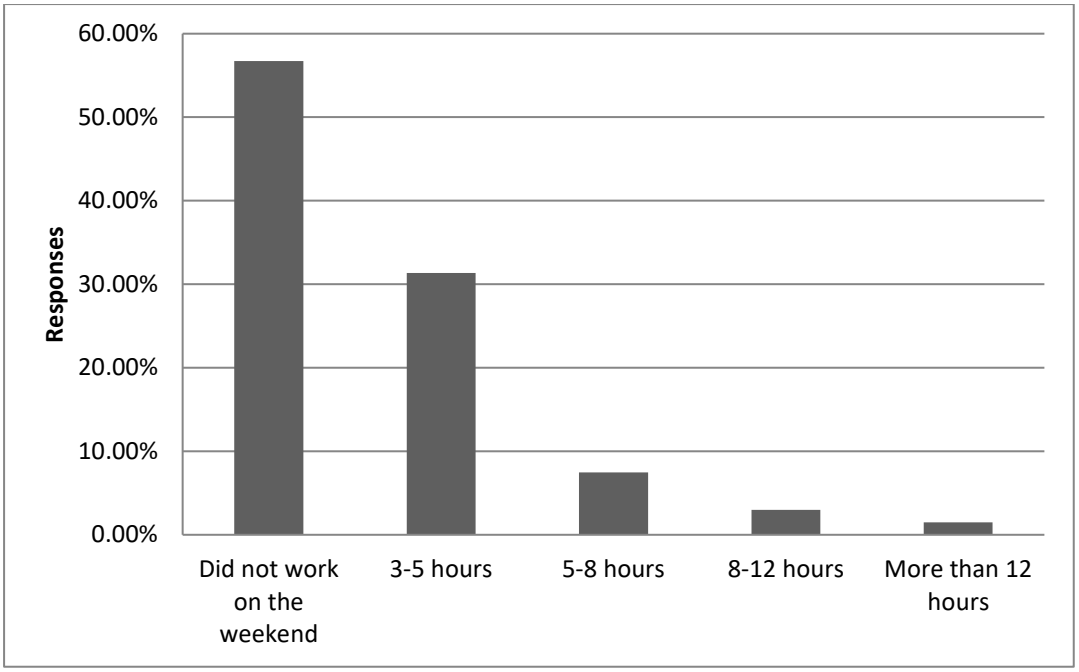


Figure 15. Work during the weekend per weekend

Question 6 of the survey is aimed to find out the percentage of employees working on their leave. Figure 16. shows that around 87% of the employees have reported working during their leave. This is a shocking discovery since employees should be using their leave to get away from their work to lower their stress levels.

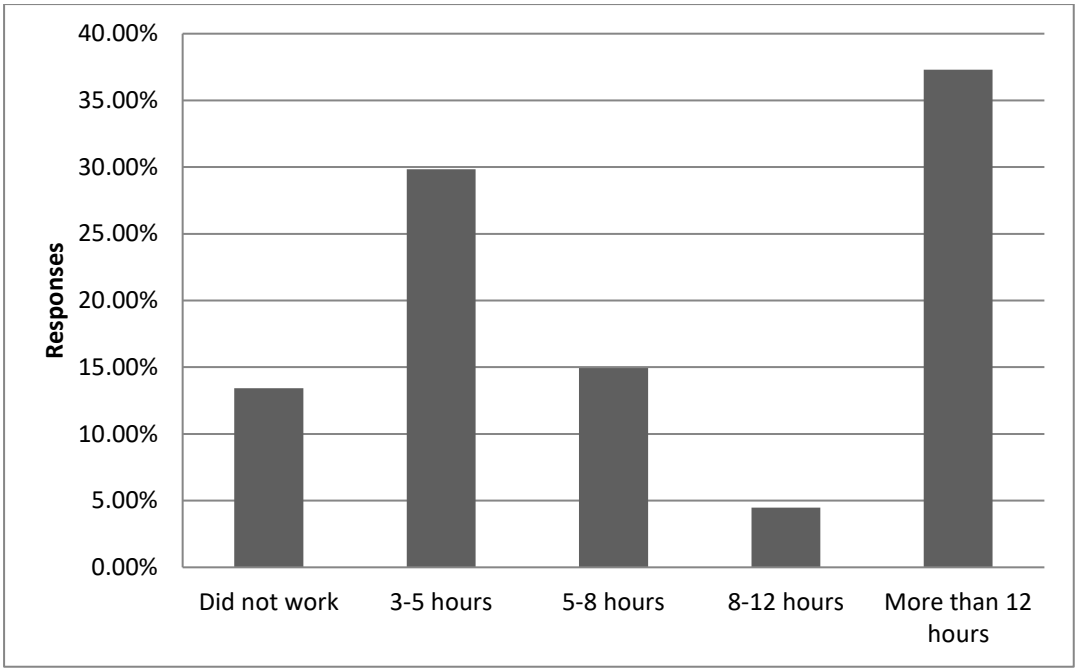


Figure 16. Work during vacation

Question 7 of the survey is aimed to determine if the employee's workload was changed after 2015 restructure, it also rules out employees who joined after the restructure. Figure 17. shows that around 63% of employees have reported an increase in their workload. This result is expected because the number of employees is lowered by 30%, which results in an increase in workload for the remaining employees.

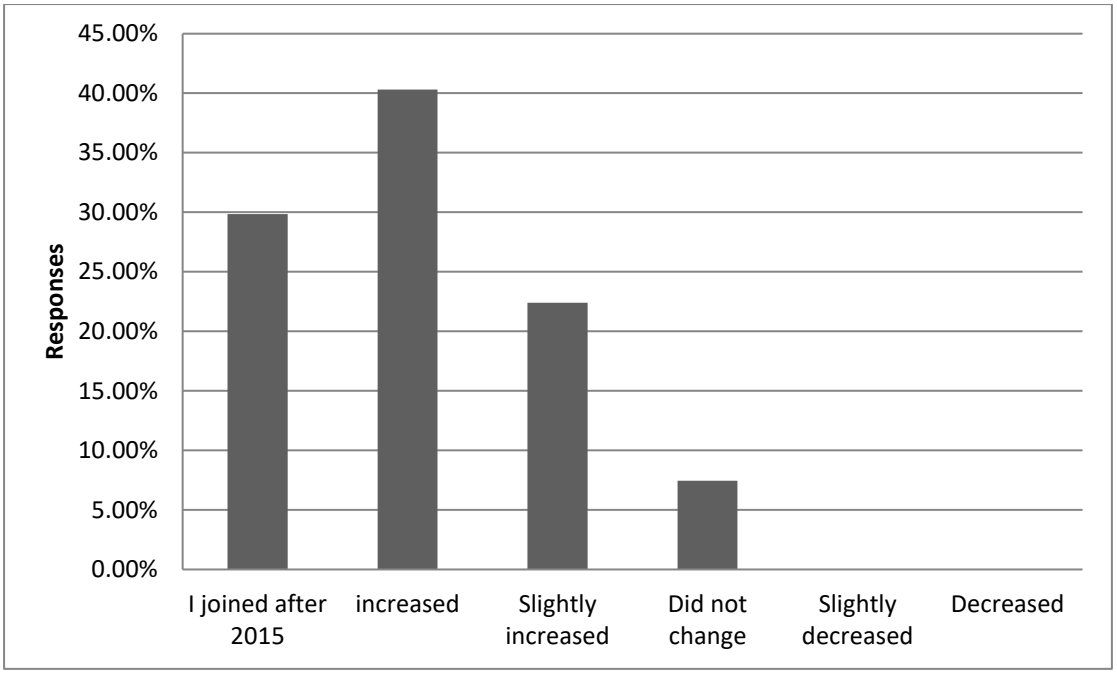


Figure 17. Workload comparison between before and after 2015 restructure

Question 8 of the survey is aimed to investigate the different ways to reduce the workload on employees. Figure 18. shows that employees find that the most effective ways to reduce workload are having more realistic deadlines and hiring more employees. Some of the other suggested methods are to reduce levels of quality checks, reduce the number of corporative initiatives, and hire more competent employees.

Figure 18. Solutions to lower workload levels

Question 9 is aimed to determine if the daily required activities are unnecessary. This question refers to the admin work that the system requires such as reports, memos, filling some documents, etc. Figure 19. shows that 44% of employees agree that some of the daily activities are unnecessary, this can be one of the reasons causing employees to feel overwhelmed by the required workload.

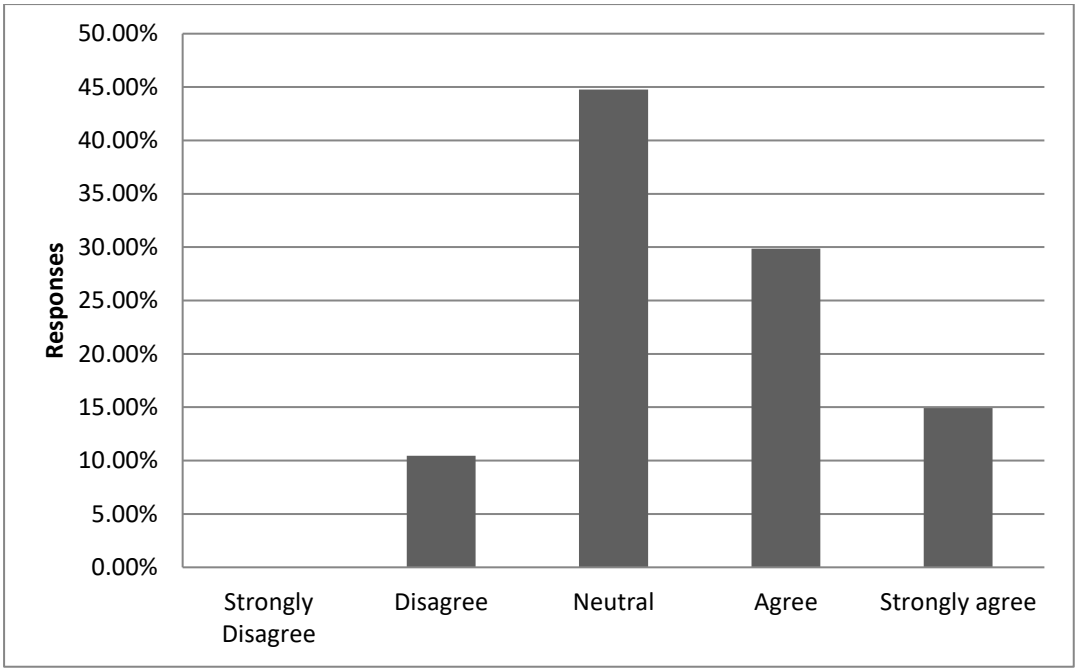


Figure 19. Necessity of daily activities

Question 10 is aimed to determine the daily activities that are time-consuming and unnecessary to the employees. Figure 20. shows that the main time-consuming is unnecessary meetings, followed by administrative tasks, and corporate initiatives. These activities contribute to the employees' workload.

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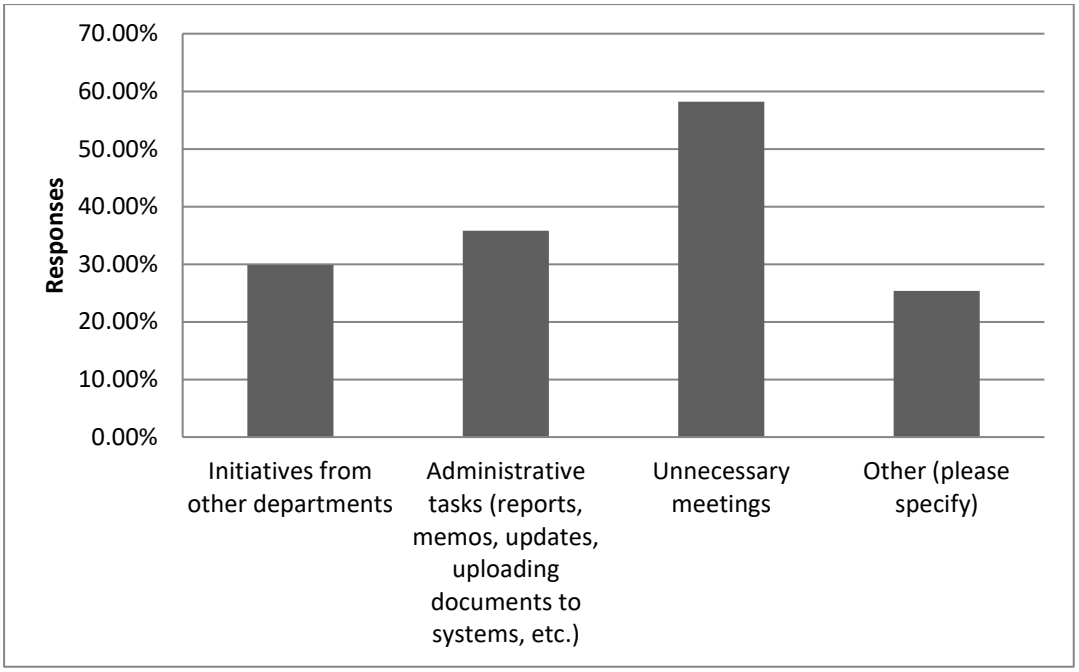

Figure 20. Unnecessary daily activities

Question 11 is aimed to determine the important activities that employees would rather focus on. Figure 21. shows that majority of employees would rather focus on field-specific work, such as engineer, design, etc. other important activities are work planning, site visits, core related work. These activities aim to improve employees' productivity.

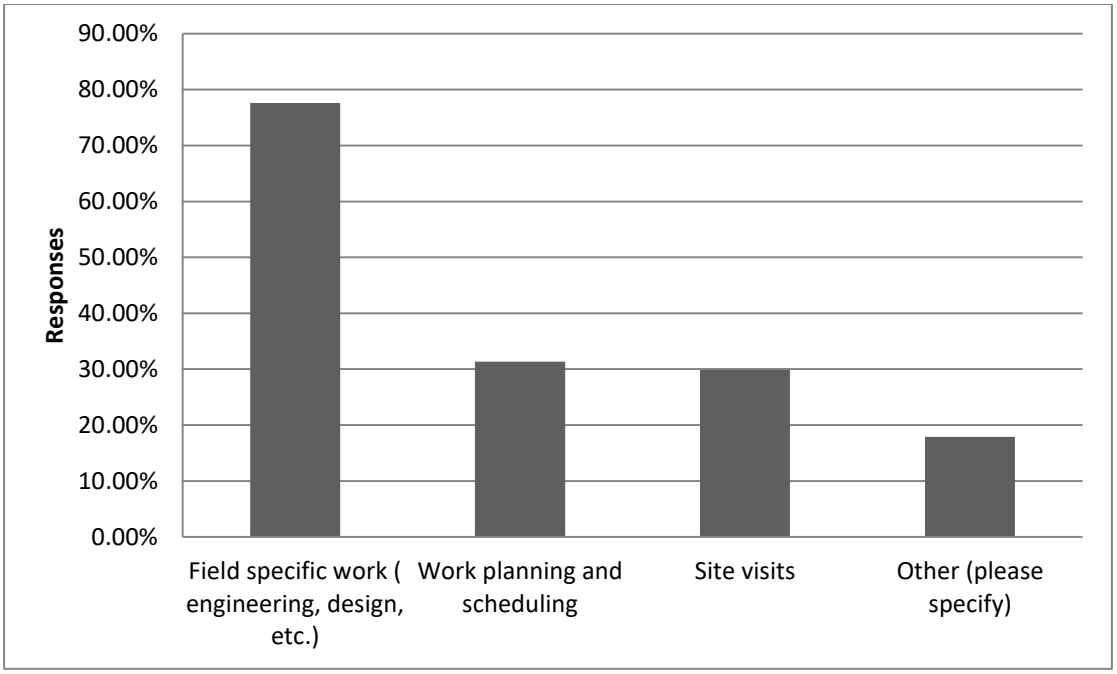

Figure 21. Important activities

Question 12 is aimed to determine the percentage of employees that are affected by their workload. Figure 22. shows that 76% of employees are affected by their workload. This means that the workload has a negative impact on the majority of employees which can lower productivity and increase stress.

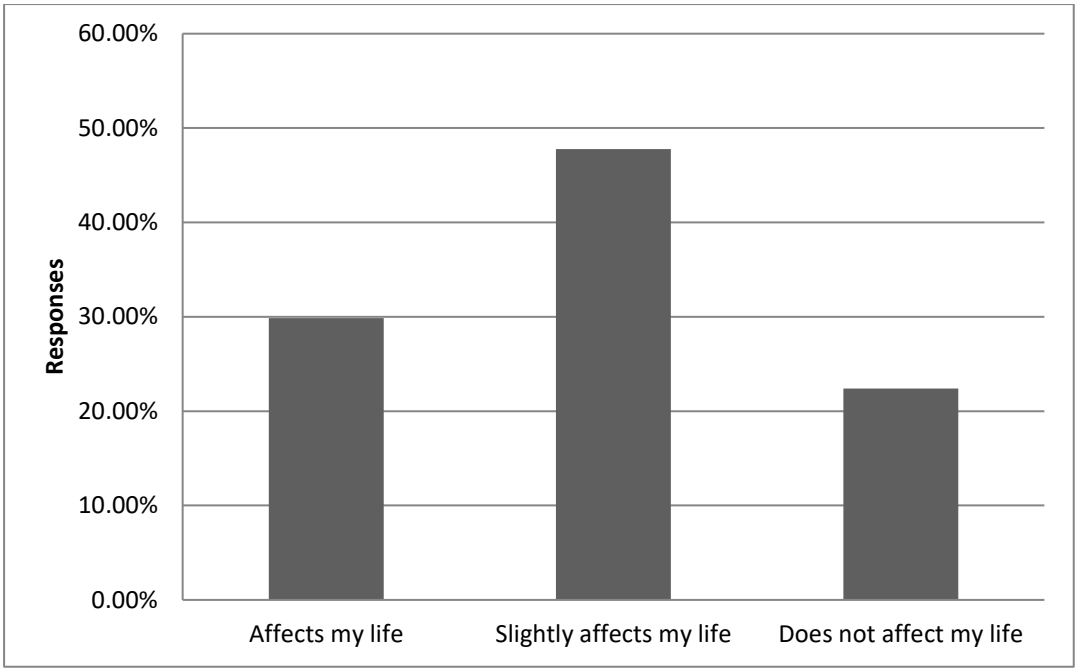

Figure 22. Employees affected by workload

Question 13 is aimed to find out how high workload affects employees within the organization, employees are able to select more than one answer. Figure 23. shows that 47% of employees reported that having a high workload takes away from family time, the same percentage of employees have reported work taking away personal time. A high 37% of employees have also reported high workload causing health issues, and 35% reported taking away social life.

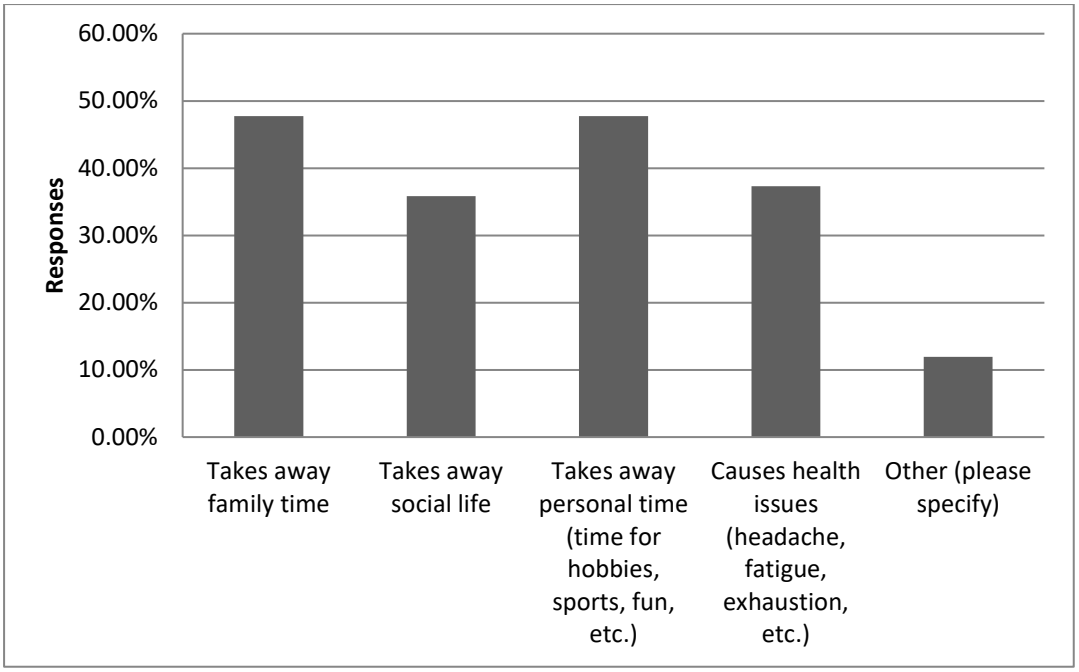

Figure 23. Impact of workload on employees' lives

Question 14 is aimed to find out how challenging employees' jobs from their perspective are. As shown in Figure 24. Around 84% of employees find their jobs to be moderate to very challenging. This can be the result of high workloads or challenging nature of work.

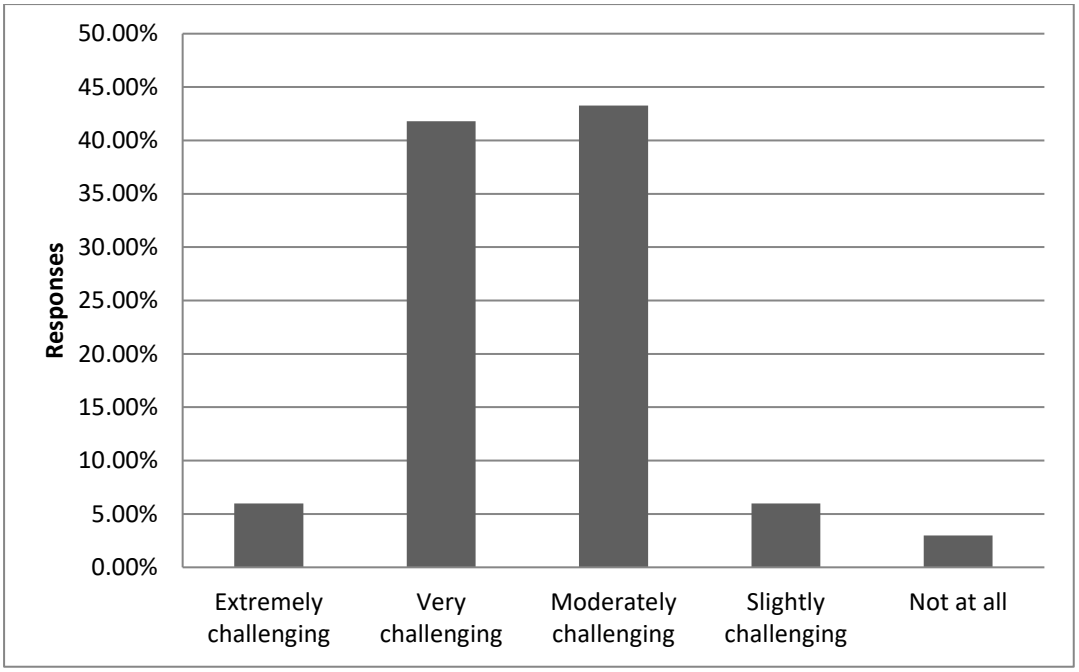

Figure 24. Difficulty of job

Question 15 is aimed to determine whether supervisors' expectations are realistic or not. As shown in Figure 25. Majority of employees find their supervisors' expectations to be realistic. Unrealistic expectations from supervisors can lead to employees being overwhelmed or feeling stressed about their work, which can lead to feeling overloaded.

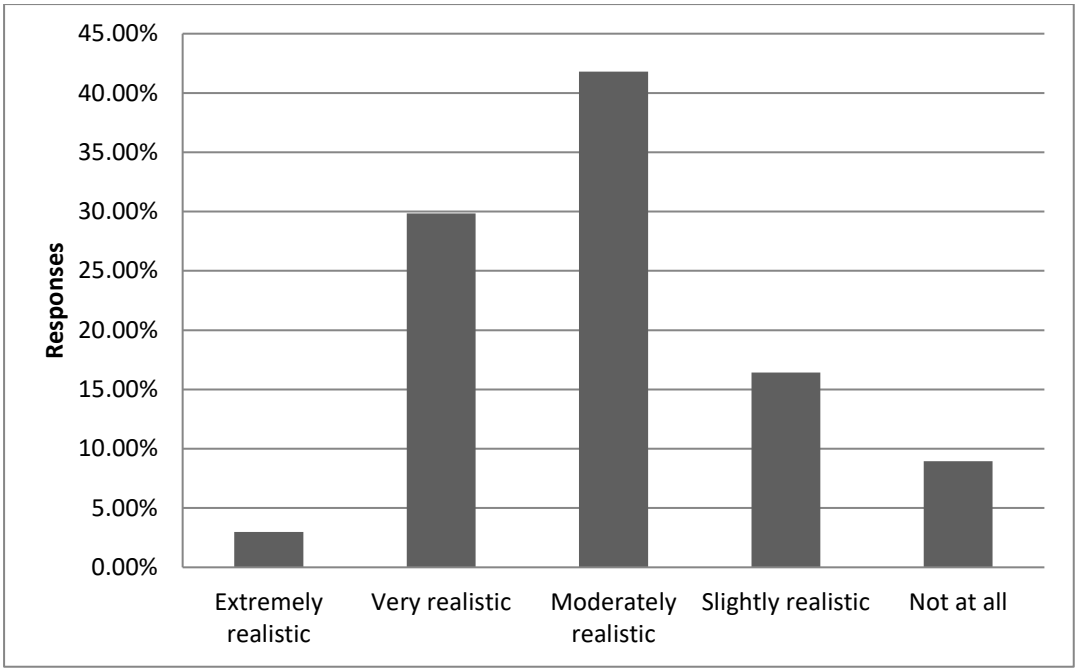

Figure 25. Expectations of supervisors

Question 16 is aimed to determine the employees' satisfaction with their salaries. As shown in Figure 26. More than half of employees have reported being well to very well paid at their job. Pay has a direct relationship with job satisfaction.

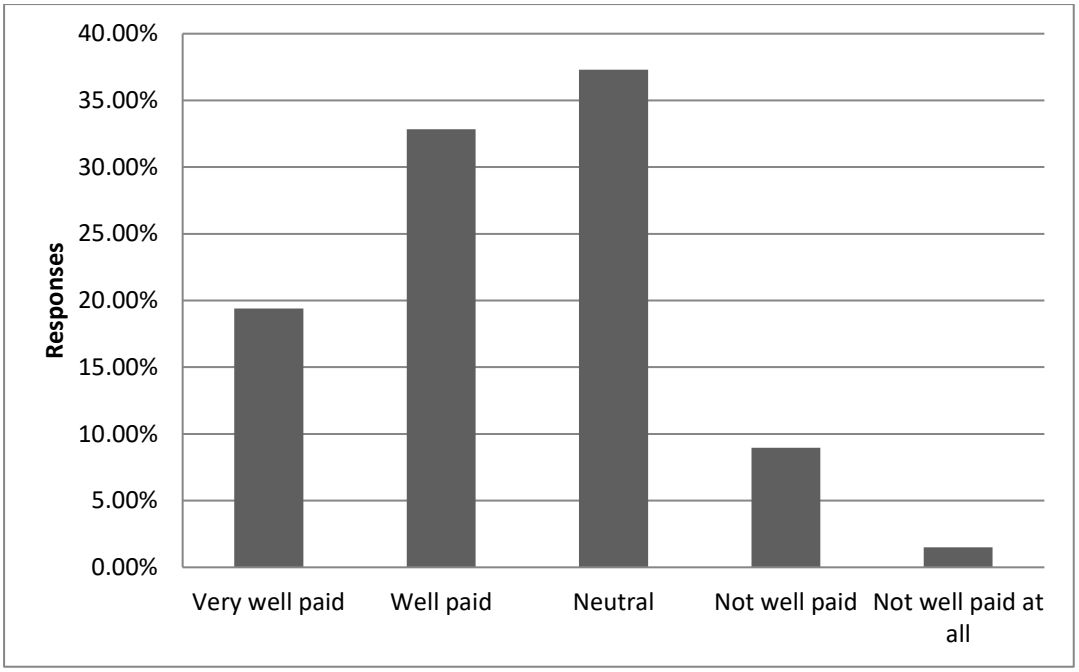

Figure 26. Satisfaction with salary

Question 17 is aimed to analyze employees' positive habits, for this question, employees are able to select more than one answer. As shown in Figure 27, 65% of employees prefer to follow a schedule, 55% always finish a task they started, 52% being exact in their work, 50% follow with their plans. It is observed that all employees have some good habits that help organize their work.

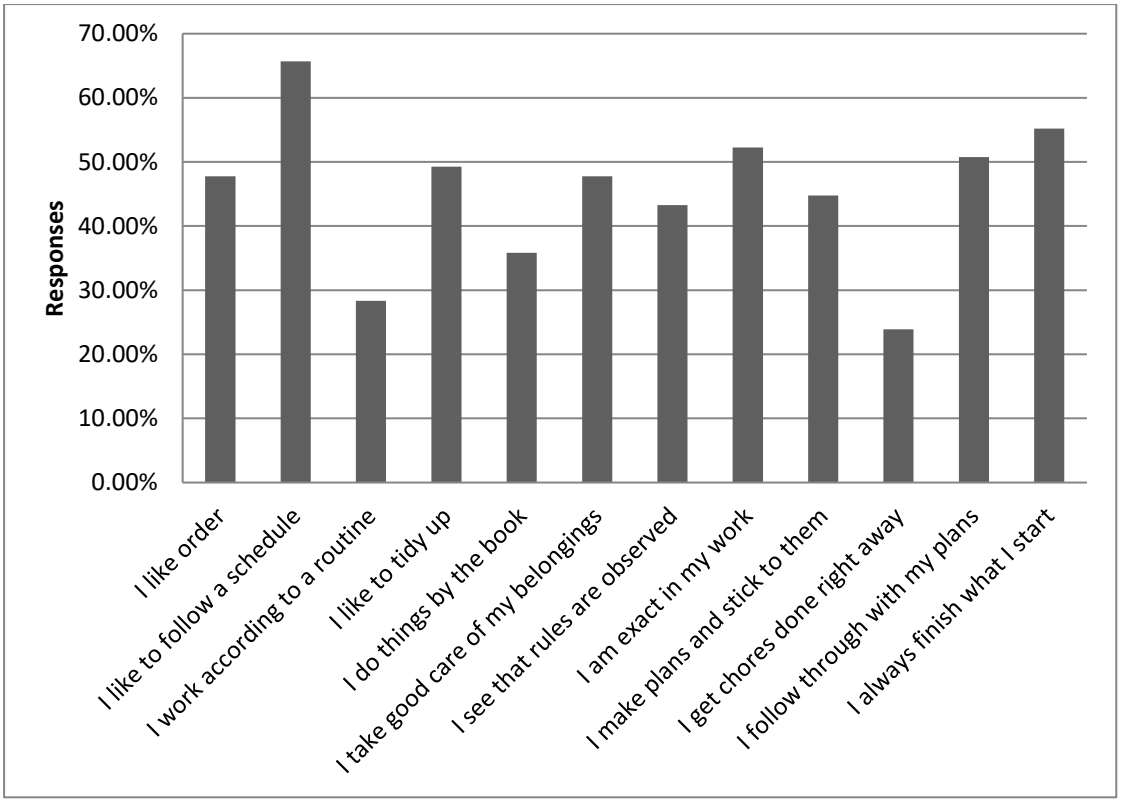

Figure 27. Positive habits

Question 18 is aimed to analyze employees' negative habits, for this question, employees are able to select more than one answer. As shown in Figure 28. A high 56% reported having none of the mentioned habits, 19% have reported disliking routine, 10% have reported needing push to get started with a task, and 8% have reported having difficulty with starting new tasks.

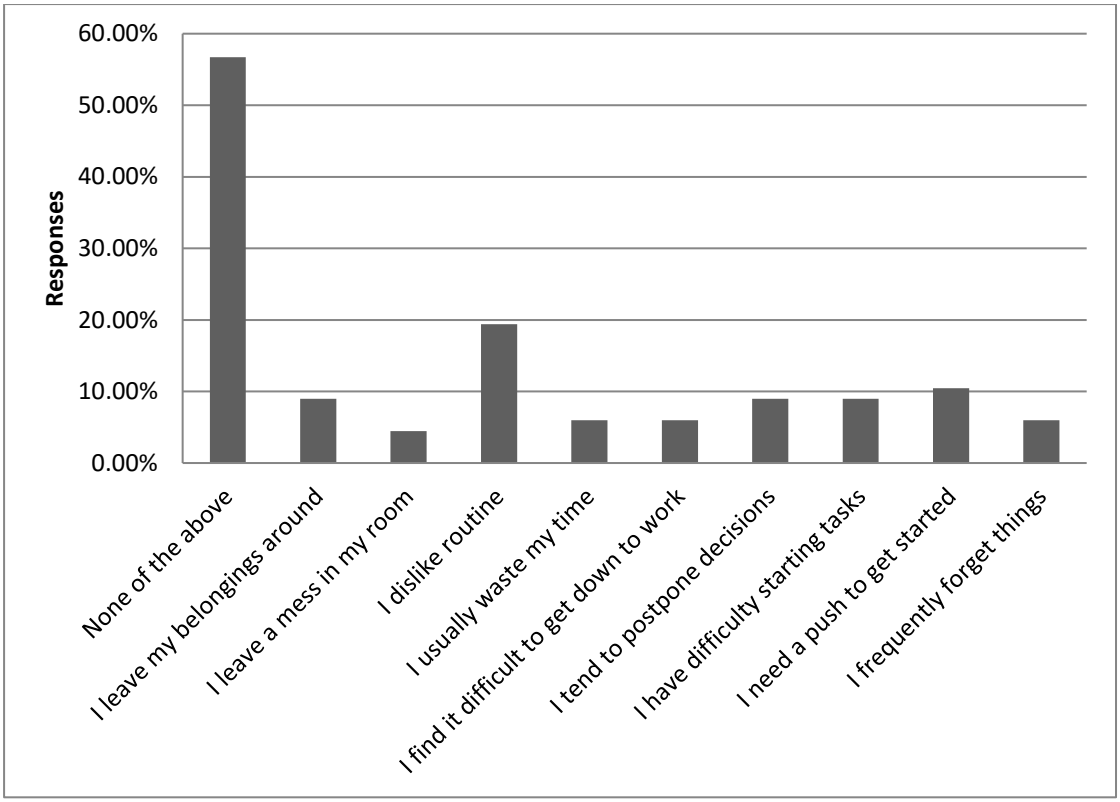

Figure 28. Negative habits

The following questions are answered only by supervisors (having subordinates):

Question 20 is aimed to find out if the number of employees within a team (after the 30% decrease) is sufficient for the work required. As shown in Figure 29. A very high 74% of supervisors have reported an insufficient to a very insufficient number of employees. This is a concern and can be one of the reasons employees are experiencing high levels of workload.

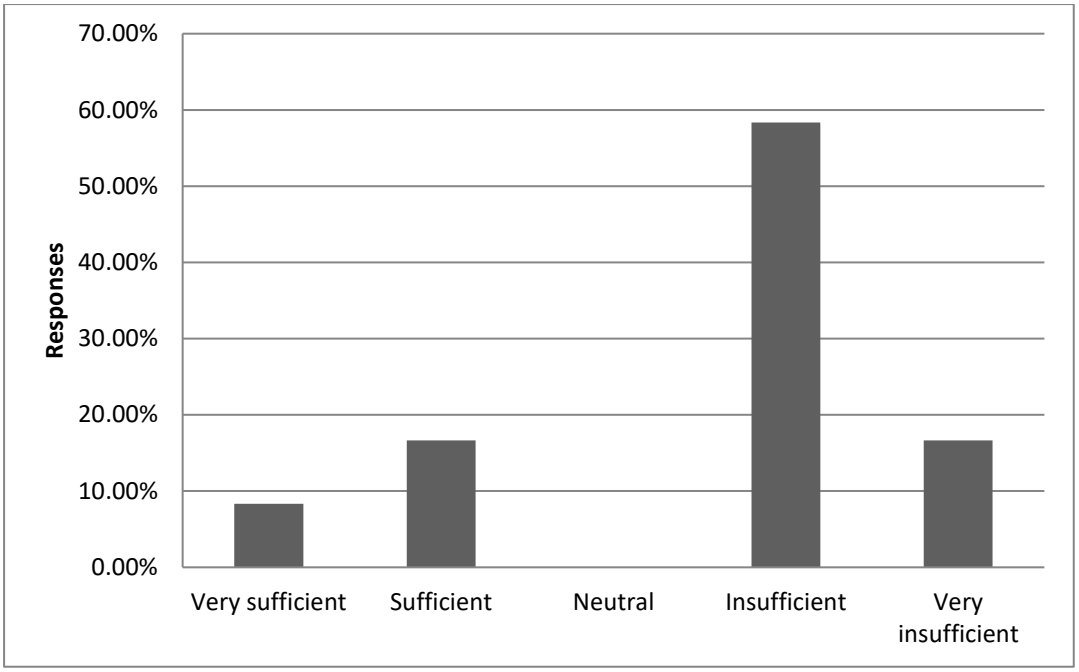

Figure 29. Sufficiency of number of employees

Question 21 is aimed to find out if work is completed by the time on time or not. As shown in Figure 30. 66% of supervisors have reported that their teams are able to complete work usually to always on time.

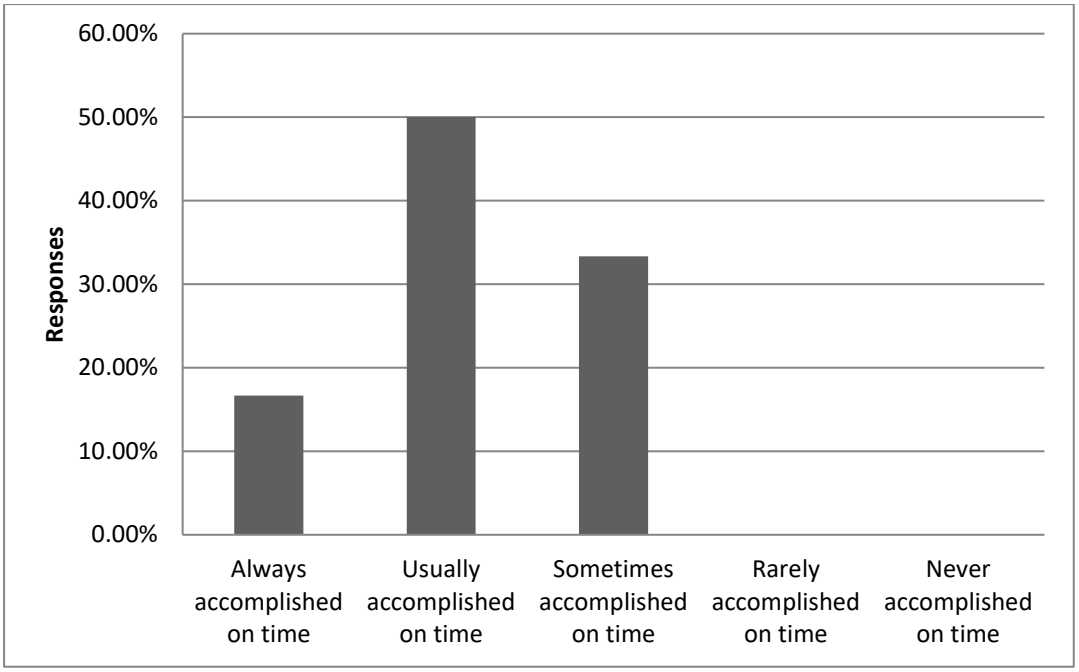

Figure 30. Work completion on time

Question 22 is aimed to determine the reasons for the delay of work, for this question, supervisors are able to select more than one answer. As shown in Figure 31. The highest selected reason is multitasking at 100%, followed by high workload at 75%, followed by time-consuming activities and, an insufficient number of employees at 58% for each. According to the supervisors, these are the reasons causing most of the delay of work within their teams.

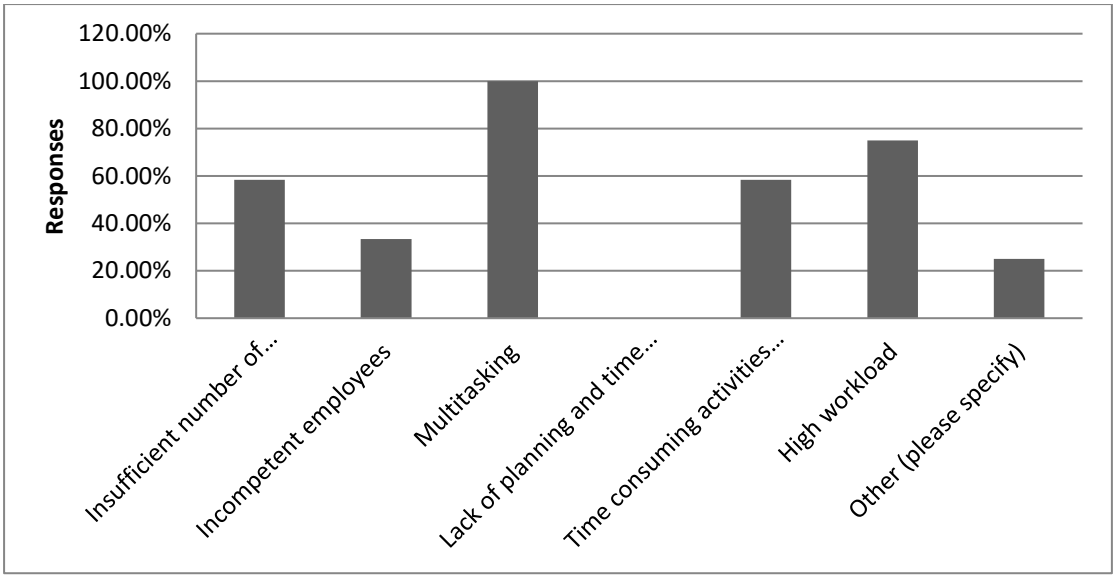

Figure 31. Reasons for work delay

Question 23 is aimed to determine if the workload on employees has increased or decreased since 2015 restructure. As shown in Figure 32. 83% if supervisors have reported an increase to a drastic increase in the workload on employees since 2015 restructure.

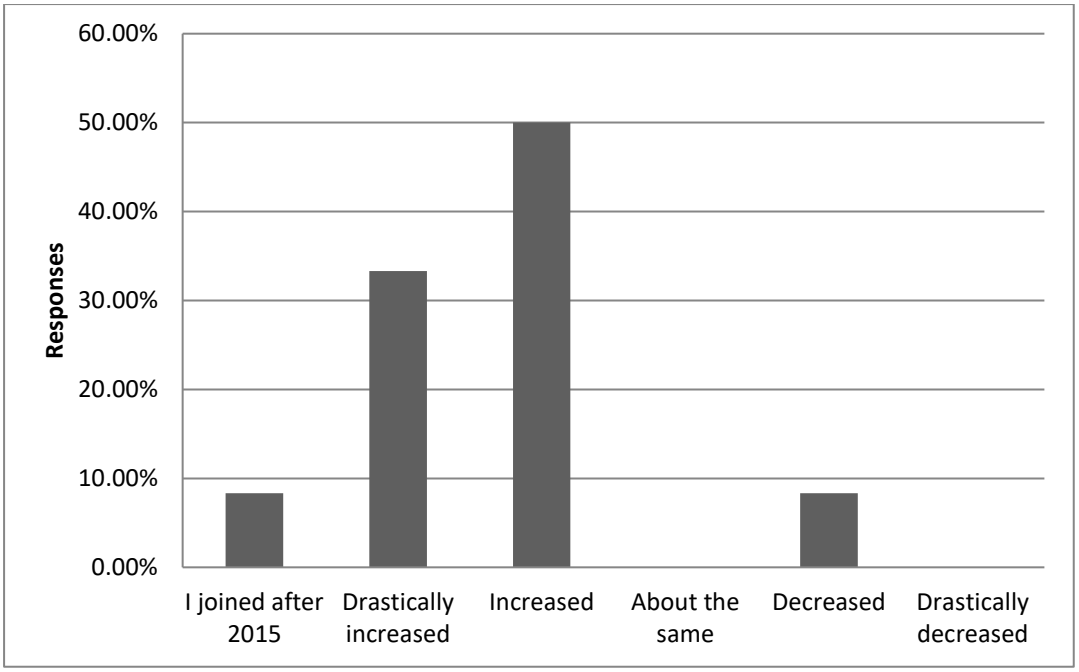

Figure 32. Workload on employees comparison before and after 2015 restructure

Question 24 is aimed to determine if supervisors' teams used to complete their work before 2015 restructure slower or faster than the present time. As shown in Figure 33. 50% of supervisors have reported that their team used to complete their work slightly too much faster before 2015 restructure. This can be due to the lower number of employees, so work is not completed as fast as it once was.

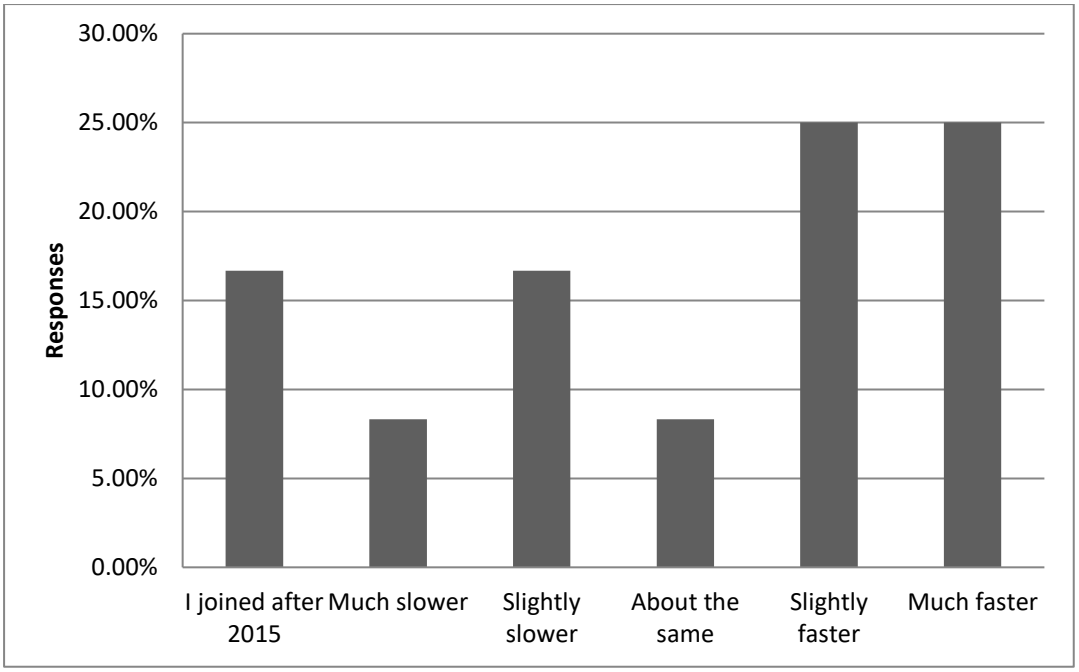

Figure 33. Completion time comparison before and after 2015 restructure

Question 25 is aimed to determine if any changes were implemented to the process of work assignment to employees after 2015 restructure. As shown in Figure 34, 83% of supervisors have reported some changes to the process of work assigned to the employees. This is expected because having the same process of work assignment with 30% fewer employees would result in some issues.

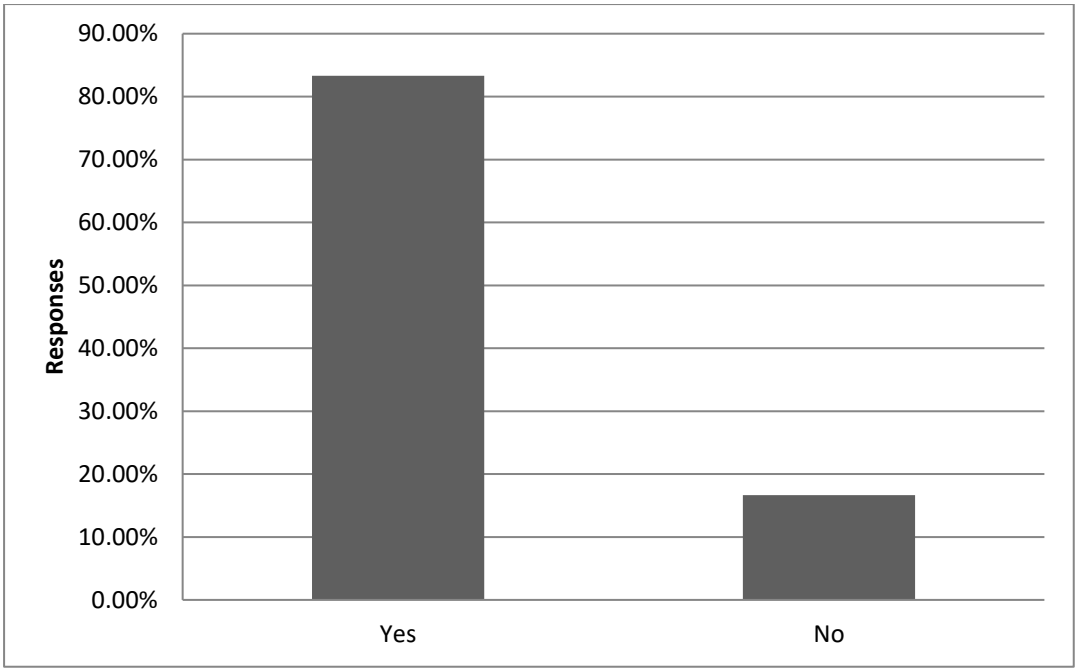

Figure 34. Changes to work assignment process after 2015 restructure

Question 26 is aimed to find out the time it took for these changes (in question 25) to be implemented. As shown in Figure 35. 50% of supervisors have reported more than 6 weeks for the changes to be implemented. This question investigates the resilience of the organization, to understand the ability to adapt to quick change with minimum compromises.

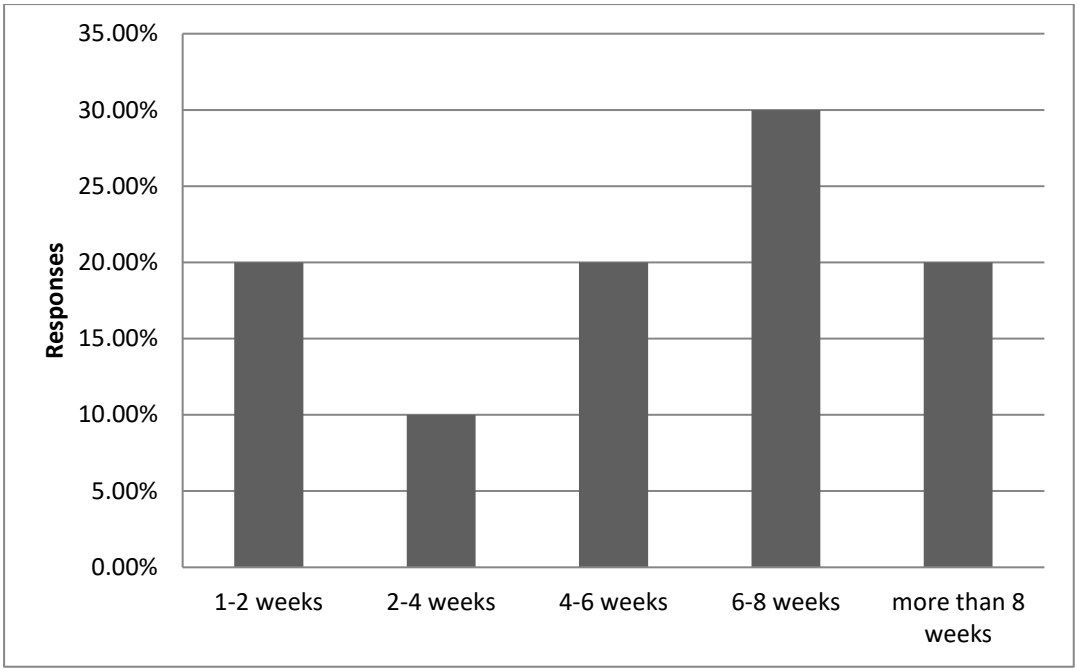

Figure 35. Time taken for work assignment process changes to be implemented

Question 27 is aimed to determine if the changes (in question 25) implemented to the process were effective with the new number of employees. As shown in Figure 36, 60% of supervisors agree that the changes implemented were effective. Implementing the changes is not enough since what is more important is if these questions were effective and useful.

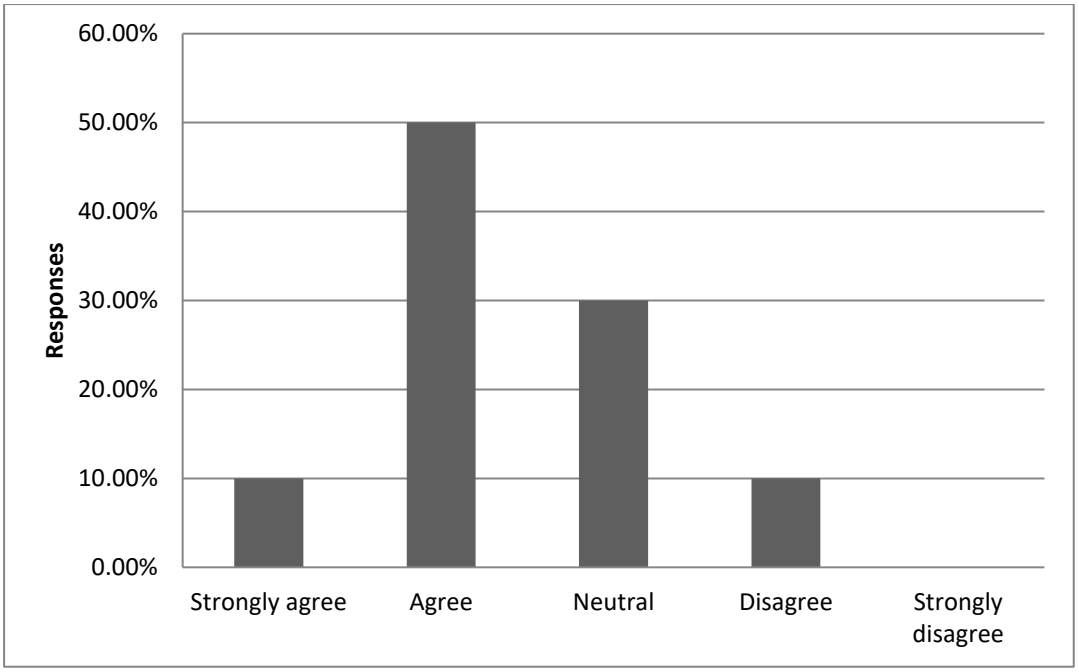

Figure 36. Effectiveness of work assignment process changes

Question 28: what do you suggest to improve your team's efficiency?

Question 28 is aimed to gather information and suggestions on how supervisors can improve their team's efficiency. Some of the suggestions include a clear definition of mandate, roles, and responsibilities, better resources management, better planning, increase the number of staff, and more staff training. These are some important suggestions that can help improve the organization's efficiency.

4.3 Survey statistical analysis

Statistical analysis generally gives insights and trends that are difficult to observe while going through the data. In order to gain deeper insights on the survey responses, Pareto charts are utilized as well as correlation analysis to find trends and patterns in the data. Such analyses can only be applied to a certain type of questions, only the questions applicable to these tools were analyzed.

The Pareto Principle states that 80% of the outcomes result from 20% of all the causes which is not always the case for survey results. As seen in Figure 37. The Pareto

Principle is not present in the result. This is due to high responses for each answer, meaning that many of the employees agree with the statements in the question. The results show that employees have reported all the negative statements with a high response rate, this shows that all employees are facing at least one of the issues mentioned.

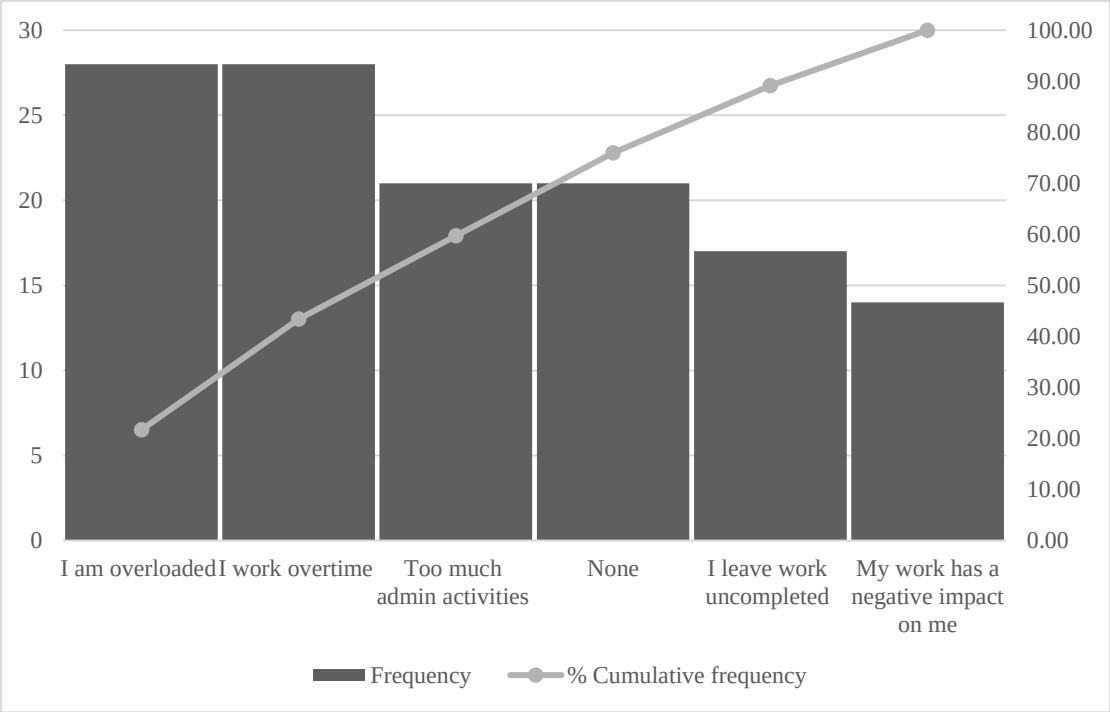

Figure 37. Pareto analysis for preception of employees on workload level (Question 1)

As seen in Figure 38. This is a good representation of the Pareto Analysis, where the first 2 suggestions account for 85% of the responses. This shows that employees believe that having realistic deadlines and hiring more employees are the most effective solution to the issue of high workload.

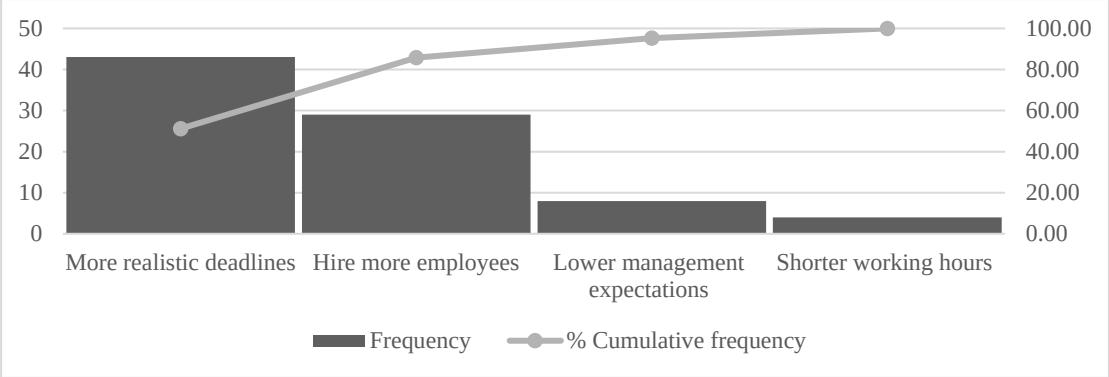

Figure 38. Pareto analysis for solutions to lower workload levels (Question 8)

As seen in Figure 39. The Pareto Principle is not observed in the results. This is due to the high responses for all answers, which shows that all employees are facing the stated issues in their jobs.

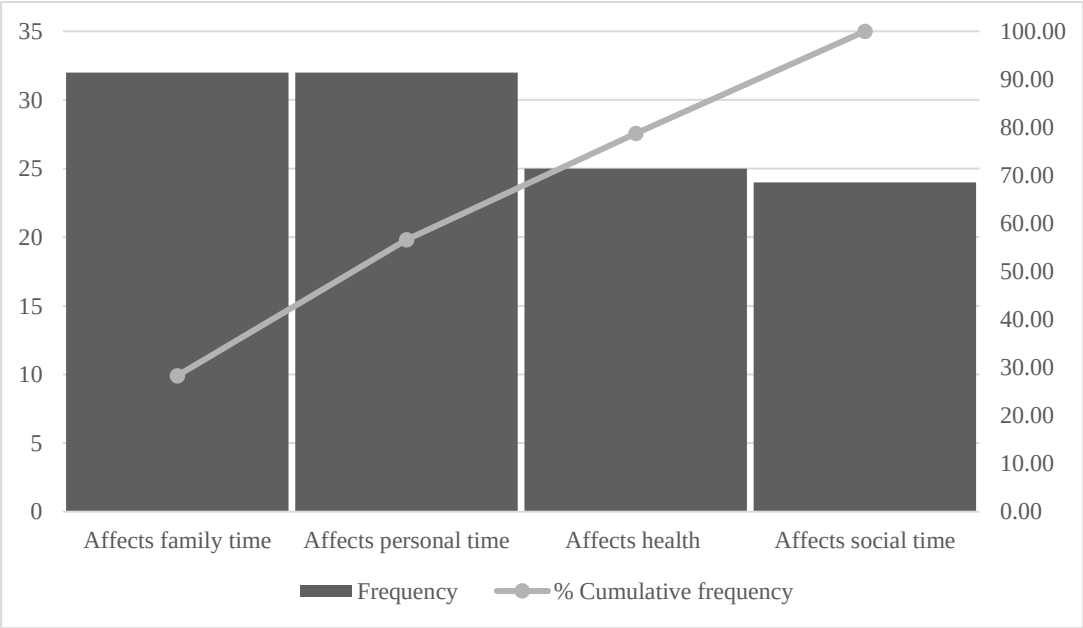

Figure 39. Pareto analysis for the impact of workload on employees' lives (Question 13)

As seen in Figure 40. The Pareto analysis can be observed, three of the options account for 80% of the results, this shows that the three main reasons for work delay are employees multitasking, being overloaded with work, and unnecessary activities.

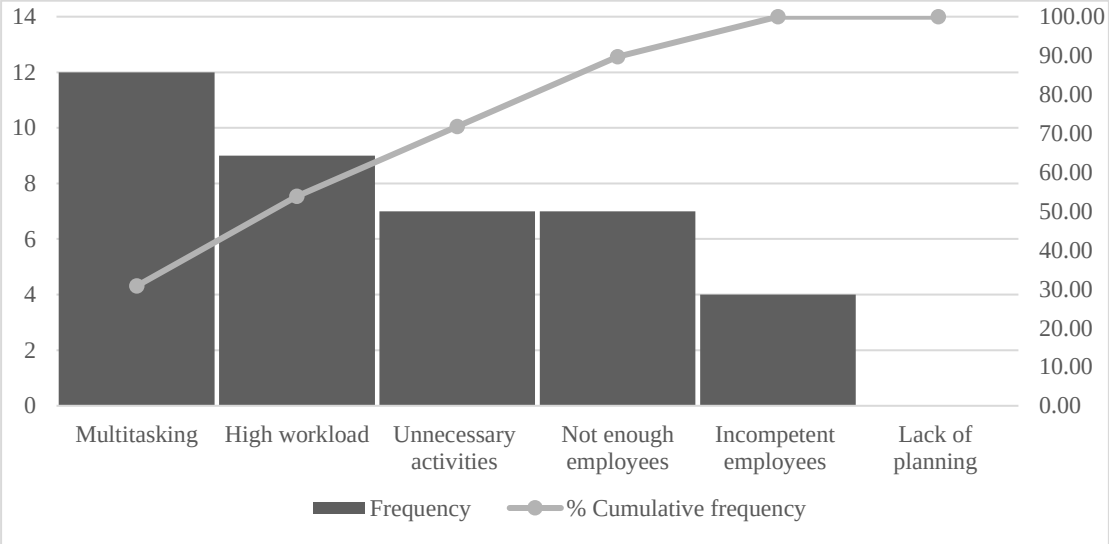

Figure 40. Pareto analysis for reasons for work delay (Question 22)

The correlation analysis is utilized to find correlations between the response's answers, trends that can provide deeper insights into the data collected. As shown in Table 5. Correlation analysis is used for question 1 and question 18, the correlation is performed using SPSS statistical software, the software uses Pearson correlation. Pearson correlation is an analysis tool used to measure the strength of the linear relationship between two variables. Since the correlation coefficient is lower than 0.1, the correlation is considered significant. As seen in Table 5. The result of the analysis shows the correlation between employees who tend to leave work incomplete and some of the negative habits such as leaving their belongings around, tendency to waste time, finding difficulty to work, finding difficulty starting a task, needing a push to start working, and frequently forgetting things. This is expected since negative habits result in having less time to work, thus leaving work incomplete.

Table 5. Correlation between negative statements & negative habits

		Leave belongings around	Messy room	Waste time	Difficult to work	Difficult to start a task	Need a push to start	Forget things	None
Leave work incomplete	Pearson Correlation	.298*	0.205	.287*	.287*	.298*	.249*	.287*	-.252*
	Sig. (2-tailed)	0.014	0.095	0.018	0.018	0.014	0.042	0.018	0.040
	N	67	67	67	67	67	67	67	67

In Table 6. Correlation analysis is conducted between question 2 and question 17. As shown in Table 6. The result shows a correlation between employees taking good care of their belongings, employees who are exact at work, and employees reporting manageable workloads.

Table 6. Correlation between workload manageability & positive habits

		Take good care of belongings	Being exact in work
Manageable workload	Correlation Coefficient	-.267*	-0.213
	Sig. (2-tailed)	0.029	0.083
	N	67	67

As seen in the correlation results between question 1 and question 10 in Table 7. Correlation is observed between employees reporting unnecessary meetings, unnecessary admin activities, and being overloaded with work. This shows that unnecessary meetings and admin activities can be contributing to employees being overloaded.

Table 7. Correlation between negative statements & unnecessary activities

		Unnecessary meetings	Unnecessary admin activities
I am overloaded with work	Pearson Correlation	0.227	.300*
	Sig. (2-tailed)	0.065	0.013
	N	67	67

As seen in the correlation results between question 18 and question 33 in Table 8. It is observed that there is a positive correlation between work experience and some of the positive habits. This shows that employees who have adopted positive habits such as following a schedule, observing rules, being exact in their work, getting chores done right away, and tendency to finish what has been started are the employees who have longer years of experience. This is expected since long experience can teach the employee to adopt more habits in order to be successful.

Table 8. Correlation between positive and work experience

		Like to follow schedule	Like to observe rules	Exact in work	Get chores done right away	Like to finish what is started
Work experience	Correlation Coefficient	.394**	0.235	0.220	0.219	.242*
	Sig. (2-tailed)	0.001	0.056	0.074	0.076	0.049
	N	67	67	67	67	67

CHAPTER 5: MATHEMATICAL MODEL

5.1 Mathematical model

In this chapter, a mathematical model is developed to optimize the process of projects within the organization by minimizing the total cost tardiness penalty and any additional capacity of the project.

The following is a list of input data and notation utilized in the study:

n: Number of projects,

st: Number of stages,

nst: Number of projects x Number of stages,

R: Number of resources (Project manager, Engineers)

H: Time horizon,

b_{rt}*:* Capacity of resource r at period t,

σ_{rt}*:* The cost of adding extra resource r at period t,

m_j*:* Number of execution modes of project j,

a_{jrk}*:* Consumption of resource r by project j under mode k,

p_{jk}*:* Processing time of project j under mode k,

r_j *:* start date of the project

d_j*:* Due date of project j,

w_j*:* Weight of project j,

The following decision variables are defined:

x_{jk}*:* Binary variable that takes value 1 if project j is executed under mode k, and 0 otherwise.

y_{jt}*:* Binary variable that takes value 1 if project j is executed during period t, and 0 otherwise.

s_{jt}: Binary variable that takes value 1 if project j starts at the beginning of period t, and 0 otherwise (that means, $s_{jt} = 1 \Rightarrow$ project j starts at time t).

f_{jt}: Binary variable that takes value 1 if project j finishes at the end of period t, and 0 otherwise (that means, $f_{jt} = 1 \Rightarrow$ project j finishes at time t+1).

e_{jh}: the finish time of project j at stage h

T_j: Tardiness of project j.

$$Minimize \sum_{j=1}^{n} w_j T_j + \sum_{r=1}^{R} \sum_{t=1}^{H} \sigma_{rt} z_{rt} \quad (1)$$

Subject to:

$$\sum_{k=1}^{m_j} x_{jk} = 1, \qquad j = 1, \dots, nst \tag{2}$$

$$\sum_{t=1}^{H} s_{jt} = 1, \qquad j = 1, \dots, nst \tag{3}$$

$$\sum_{t=1}^{H} f_{jt} = 1, \qquad j = 1, \dots, nst \tag{4}$$

$$\sum_{t=1}^{H} t\, s_{jt} \geq r_j, \qquad j = 1, \dots, nst \tag{5}$$

$$\sum_{t=1}^{H} t\, s_{jt} + \sum_{k=1}^{m_j} p_{jk}\ x_{jk} = \sum_{t=1}^{H} t f_{jt}, \qquad j = 1, \dots, nst \tag{6}$$

$$\sum_{t=1}^{t} s_{jt} - \sum_{t=1}^{t} f_{jt} = y_{jt}, \qquad j = 1, \dots, nst; t = 1, \dots, H \tag{7}$$

$$e_{vh} \geq e_{vh-1} + \sum_{k=1}^{m_j} p_{v*h,k}\ x_{v*h,k}, \quad v = 1, \dots, n, h = 2, .. st \tag{8}$$

$$e_{vh} = \sum_{t=1}^{H} t f_{v*h,t}, \qquad v = 1, \dots, n, h = 1, .. st \tag{9}$$

$$\sum_{j=1}^{n} \sum_{k=1}^{m_j} a_{jrk}\ u_{jkt} \leq b_{rt} + z_{rt} \quad r = 1, \dots, R, ; t = 1, \dots, H \tag{10}$$

$$T_j \geq \sum_{t=1}^{H} t f_{jt} - d_j, \qquad j = 1, \dots, n \tag{11}$$

$$x_{jk} + y_{jt} \leq u_{jkt} + 1, \qquad j = 1, \dots, n; k = 1, \dots, m_j; t = 1, \dots, H \tag{12}$$

$$x, y, z\ \ binary, \tag{13}$$

$$T, s, f, u \geq 0, \tag{14}$$

The objective function (1) minimizes the total penalty and any additional capacity. Constraint (2) requires that each project is assigned exactly to one mode. Constraint (3) requires that each project is assigned exactly to one start time. Constraint (4) requires that each project is assigned exactly to one finish time. Constraint (5) requires that each project is starting at least from the real start date. Constraint (6) enforces that the finish time of a project is equal to the sum of its start time and processing time. Constraint (7) requires that if project *j* has started processing at time given $\sum_{t=1}^{t} s_{jt} = 1$ and its finishing time at time given $\sum_{t=1}^{t} f_{jt} = 1$, then j is processed during the specified period and y_{jt} = 1. Constraint (8) requires that the completion time of project j at any stage is greater than the completion time at the previous sage plus the processing time at the same stage. Constraint (9) computes the finish time of the project at the different stages. Constraint (10) enforce the capacity constraint is met. Constraint (11) enforce the tardiness constraint. Constraint (12) enforce linearization. Constraints (13), (14) are both for non-negativity.

5.2 Mathematical model results

The results of our proposed mathematical model were implemented in the IBM ILOG CPLEX Optimization Studio 20.1.0.0 version. Randomly generated problems with 15 to 40 projects over the 5 stages were tested on Windows 10 operating system with Intel i7@1.99 GHz, and 16.00 GB of RAM. The results of the proposed model are summarized in Table. 9.

Table 9. Results of the mathematical model for 15 to 40 projects over the five stages

Problem size	# Of projects x # of stages	# Of constraints	# Of variables	Run time (S)
Instance 1 15	75	2693	5195	9.29
Instance 2 20	100	4734	10408	18.48
Instance 3 25	125	6523	16195	110.11
Instance 4 30	150	8692	22596	300.03
Instance 5 40	200	10898	29698	900.17

It is worth mentioning that for problem 5 with 40 projects over 5 stages the instance was not solved to optimality after 15 minutes time limit. However, the real problem has more than 150 projects per year. This show clearly the limitation of mathematical problems in solving large problems. Therefore, metaheuristics could be useful to solve this kind of real-life problem. In order to solve problems with larger instances (more than 40) to better model the real-life problem, the mathematical model can be further improved utilizing heuristic or metaheuristic can be possible options to solve the problem.

CHAPTER 6: CONCLUSIONS, RECOMMENDATIONS, AND FUTURE WORK

6.1 Conclusions

This thesis used a simulation model, a survey, and a mathematical model to analyze the workload on employees as well as shedding the light on how a major organizational restructure can affect the distribution of workload among the employees. The simulation model was used to accurately model the project lifecycle process using Anylogic software to gain insights by visualization on how the process operates and find the areas of improvement. The results of the simulation showed that the utilization of the discipline engineers within the organization is a high 83%, yet it is not 100% utilization.

The survey results showed that the majority of employees are facing high workloads and it is affecting many aspects of their lives. The survey also showed that after the 2015 restructure, the workload on employees has increased significantly. This increase has resulted in employees working overtime, during the weekend, and even during their vacations. Although not all employees have reported being overloaded with work, some employees reported that their workload is very manageable, while others reported very unmanageable. The survey results have also showed some patterns within the data, it showed that some of the positive habits adopted by some employees actually help with managing the workload, on the other hand, some of the negative habits adapted by some employees contribute to feeling overwhelmed by work or overloaded. This information can be used to educate the employees on the importance of adopting positive habits within the workplace to help reduce the stress of the job. Combining the results from the simulation model and the results from the survey analysis, it is concluded that the workload is not properly distributed among the employees. This presents a major issue since it is affecting the efficiency of the department. This shows

that there is room for improving the workload distribution to increase the utilization and productivity of the department by properly distributing the workload among the employees.

In order to reduce the overall costs associated with project delays, the mathematical model is utilized to effectively reduce the cost within the available resources. This will ensure that the costs are reduced without pushing employees with higher workloads. The mathematical model will help properly assign the number of available employees including discipline engineers, project managers, and supporting department personnel to the projects required to be completed while considering the importance of each project with a classification of priority level. The results showed that the mathematical model is able to solve small sized-problem with up to 30 projects and failed to solve problems with 40 projects within fifteen minutes time limit.

6.2 Recommendations

In order to solve the workload distribution issue present in the department, some recommendations are proposed. First, Distributing the workload evenly will not be an effective solution, each employee has different years of experience, different abilities, different tolerance of workload, and overall different personalities that makes the even workload distribution ineffective. Instead, the workload should be distributed considering each employees' abilities, personality, and experience in order to have an effective distribution. Second, hiring more employees to the department, especially discipline engineers. Third, having strict working hours prevents employees from working during weekends and vacations to reduce fatigue, stress, and allow for relaxation. Finally, have more realistic deadlines for the projects and tasks required

from employees to prevent feeling stressed, overwhelmed, and to allow time for the employee to deliver quality work.

6.3 Future works

For future work, the methods used in this thesis can be scaled to cover the entire organization instead of the engineering department only. The mathematical model will be more complex, as well as the simulation model, but it will be very insightful to upper management where they will have a great overview of the processes followed within the organization. The simulation in particular can be very beneficial for upper management to test upcoming changes before implementations to understand the different aspects of the changes, as well as expect the results of the implemented changes to the organization. Finally, as future research, it is recommended to improve the performance of the mathematical model and propose some heuristics /meta-heuristics to solve this challenging problem.

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APPENDICES

Appendix A: Survey Questions

Employees Workload Assessment Survey

استبيان تقييم عبء العمل للموظفين

Dear respondents,

This survey is undertaken as part of the master thesis at the college of engineering at Qatar University. The aim of this research is to evaluate the workload experienced by employees within the organization, as well as, comparing the performance of the organization before and after 2015 restructure. The goal of this survey is to find challenges and issues that faces the employee and finding ways to improve the organizational performance.

This survey will take a maximum of 8 minutes of your time. Participation in this survey is voluntary and respondents can withdraw at any time. There are no risks and costs associated in participation in this research.

All recorded information will be confidential, and the results will be presented in aggregated form without highlighting individual responses. The results of this study will help the organization improve its business performance.

The survey can be taken in two languages: English and, Arabic.

Please confirm that you have understood/read the details of the project and agree to participate in the survey. Participation in this survey will be taken as consent from respondents. By clicking next you agree to participate in the survey.

Thank you for your time.

المشاركين الكرام،

تم إجراء هذا الاستبيان كجزء من أطروحة الماجستير في كلية الهندسة بجامعة قطر. والتي تهدف لتقييم عبء العمل الذي يواجهه الموظفين فالمؤسسة ، وكذلك تقييم الأداء المؤسسي قبل وبعد إعادةالهيكلة لعام 2015. الهدف من هذا الاستبيان هو البحث عن المشاكل والتحديات التي تواجه الموظفينوالعثور على مجالات وسبل التحسين التي من شأنها أن ترتقي بالاداء المؤسسي

سيستغرق هذا الاستبيان 8 دقائق كحد أقصى من وقتك. هذه المشاركة تطوعية، ويمكن للمشاركيين فيها الانسحاب في أي وقت. لا توجد مخاطر وتكاليف مرتبطة بالمشاركة في هذا الاستبيان

ستكون جميع المعلومات المسجلة سرية وسيتم تقديم النتائج في شكل مجمع دون تسليط الضوء على الردود الفردية. ستساعد نتائج هذه الدراسة على تحسين الأداء المؤسسي

يرجى تأكيد المشاركة في هذا الاستبيان من خلال قراءة وفهم تفاصيل المشروع المذكورة سابقاً، وعليه سيتم اعتبار المشاركة في هذا الاستبيان بمثابة موافقة من قبل المشاركين

عند الضغط على التالي، فانك توافق على المشاركة في الاستبيان

شكرا لك على وقتك

Employees Workload Assessment Survey

استبيان تقييم عبء العمل للموظفين

*** 1. Please select any statement that applies to you (select more than one)**
الرجاء اختيار الجملة المناسبة لوضعك (أكثر من اختيار واحد)

- [ ] I am overloaded with work
أنا مضغوط في العمل

- [ ] There is too much regulatory or admin activities in my work
هناك العديد من الأعمال التنظيمية و الادارية في عملي

- [ ] My work has a negative impact on my health, personal, or social life
لعملي تأثير سلبي على صحتي أو حياتي الشخصية أو الاجتماعية

- [ ] I regularly work beyond work hours
غالبا ما أعمل في خارج أوقات العمل

- [ ] I regularly leave work uncompleted at the end of the day
غالبا ما أترك العمل غير مكتمل في نهاية اليوم

- [ ] None of the above
لا شيء مما بالأعلى

*** 2. Do you feel that your workload is manageable?**
هل تشعر بأنك قادر على ادارة أعباء عملك؟

- ○ Not manageable
غير قابل للإدارة

- ○ Somewhat manageable
يمكن إدارته إلى حد ما

- ○ Moderately Manageable
يمكن إدارته بشكل معتدل

- ○ Manageable
يمكن التحكم فيها

- ○ Very manageable
يمكن التحكم فيه للغاية

*** 3. During the last week, approximately how many hours did you work? (Normal shift: 40 hours / week)**

الرجاء تحديد عدد ساعات العمل المنجزة خلال الأسبوع الماضي (مناوبة عادية: 40 ساعة / أسبوع)

- Less than 40 hours
  ساعة40 أقل من
- 40 hours
  40ساعة
- 40 - 45 hours
  40-45ساعة
- 45 - 50 hours
  45-50ساعة
- More than 50 hours
  ساعة50أكثر من

* **4. In the last week, how many evenings did you work (after 2:30 pm)?**

الرجاء تحديد عدد الايام التي تم العمل فيها (بعد 2:30 مساءً) خلال الأسبوع الماضي؟

- Did not work in the evening
  لم أعمل في المساء
- 1-2 evenings
  1-2يوم
- evenings more or 3
  3أيام أو أكثر

* **5. In the last week, approximately how many hours did you work on the weekend?**

الرجاء تحديد عدد ساعات العمل المنجزة خلال عطلة الأسبوع الماضي؟

- Did not work on the weekend
  لم أعمل في عطلة نهاية الأسبوع
- 3-5 hours
  3-5ساعات
- 5-8 hours
  5-8ساعات
- 8-12 hours
  8-12ساعة
- More than 12 hours
  ساعة12أكثر من

*6. In your last leave, approximately how many hours did you work on your leave (hours during the entire leave)?

الرجاء تحديد عدد ساعات العمل المنجزة خلال عطلتك السنوية الأخيرة(ساعات خلال الإجازة بأكملها)؟

- Did not work
  لم اعمل خلال عطلتي
- 3-5 hours
  ساعات 3-5
- 5-8 hours
  ساعات 5-8
- 8-12 hours
  ساعة 8-12
- More than 12 hours
  أكثر من 12 ساعة

7. Has your workload changed since the 2015 restructure?

هل تغير عبء العمل لديك منذ إعادة الهيكلة عام 2015؟

- increased
  زاد
- Slightly increased
  زاد قليلا
- Did not change
  لم يتغير
- Slightly decreased
  انخفض قليلا
- Decreased
  انخفض
- I joined after 2015
  2015انضممت بعد عام

*** 8. What would help you to reduce your workload?**

أي من الاختيارات التالية قد تساعدك في التقليل من أعباء عملك؟

- [ ] Hire more employees
تعيين المزيد من الموظفين

- [ ] Lower management's expectations
خفض سقف التوقعات

- [ ] More realistic deadlines
تحديد مواعيد نهائية أكثر واقعية

- [ ] Shorter working hours
تقليل ساعات العمل

- [ ] Other (please specify)
يرجى التحديد(غير ذلك)

*** 9. Do you agree that some of the daily activities are unnecessary?**

هل توافق على أن بعض الأنشطة اليومية غير ضرورية؟

- ○ Strongly Disagree
أرفض بشدة

- ○ Disagree
أرفض

- ○ Neutral
حيادي

- ○ Agree
موافق

- ○ Strongly agree
موافق بشدة

*** 10. What daily activities do you feel are unnecessary and take away your time for more important tasks?**

ماهي الأعمال اليومية التي تشعر بأنها غير ضرورية في عملك وتأخذ الكثير من الوقت؟

- [ ] Initiatives from other departments
مبادرات خاصة بإدارات أخرى

- [ ] Administrative tasks (reports, memos, updates, uploading documents to systems, etc.)
الأعمال الإدارية (كالتقارير، المذكرات، التحديثات ، رفع المستندات إلى الأنظمة... الخ)

- [ ] Unnecessary meetings
الاجتماعات الغير ضرورية

- [ ] Other (please specify)
يرجى التحديد(غير ذلك)

*** 11. What activities do you feel are more important and should take more of your time?**

ماهي الأعمال اليومية التي تشعر بأنها أكثر أهمية وتحتاج للمزيد من الوقت؟

- [ ] Field specific work (engineering, design, etc.)
الأعمال الفنية التخصصية (الهندسة ، التصميم،...الخ)

- [ ] Work planning and scheduling
أعمال التخطيط والجدولة

- [ ] Site visits
الزيارات الميدانية

- [ ] Other (please specify)
يرجى التحديد(غير ذلك)

*** 12. Do you feel that your workload at work affects your life outside of work?**

هل تشعر أن أعباء العمل تؤثر على حياتك الخاصة؟

- ○ Affects my life
يؤثر على حياتي

- ○ Slightly affects my life
يؤثر قليلا على حياتي

- ○ Does not affect my life
لا يؤثر على حياتي

*** 13. How does your workload affect your life?**

يف تؤثر اعباء عملك على حياتك الخاصة؟

- [ ] Takes away family time
تأخذ من وقت العائلة

- [ ] Takes away social life
تأخذ من حياتي الاجتماعية

- [ ] Takes away personal time (time for hobbies, sports, fun, etc.)

تأخذ من وقتي الخاص (الهوايات، الرياضة، الترفيه)

- [ ] Causes health issues (headache, fatigue, exhaustion, etc.)
تتسبب في المشاكل الصحية (الصداع، التعب، الارهاق،...الخ)

- [ ] Other (please specify)
يرجى التحديد(غير ذلك)

*** 14. How challenging is your job?**

ما مدى صعوبة عملك؟

- Extremely challenging
صعب جداً
- Very challenging
صعب
- Moderately challenging
صعب بشكل معتدل
- Slightly challenging
صعب بعض الشيء
- Not at all
بسيط(غير صعب)

*** 15. How realistic are the expectations of your supervisor?**

هل توقعات مشرفك واقعية؟

- Extremely realistic
واقعية جداً
- Very realistic
واقعية
- Moderately realistic
واقعية بشكل معتدل
- Slightly realistic
واقعية بعض الشيء
- Not at all
غير واقعية

*** 16. Are you well paid for the work that you do?**

هل راتبك جيد للعمل الذي تقوم به؟

- Very well paid

أنا راتبي جيد جدا

- Well paid
  أنا راتبي جيد
- Neutral
  حيادي
- Not well paid
  راتبي ليس جيدا
- Not well paid at all
  راتبي ليس جيدًا على الإطلاق

* **17. Please select that applies to you**

يرجى تحديد ما ينطبق عليك

- [ ] I like order
  أنا أحب النظام
- [ ] I like to follow a schedule
  أحب أن أتبع جدول الزمني
- [ ] I work according to a routine
  أنا أعمل وف ًقا لروتين
- [ ] I like to tidy up
  أنا أحب الترتيب
- [ ] I do things by the book
  أنا أفعل أشياء حسب القانون
- [ ] I take good care of my belongings
  أنا أعتني جيدًا بممتلكاتي
- [ ] I see that rules are observed
  أرى أن القواعد يتم مراعاتها
- [ ] I am exact in my work
  أنا دقيق في عملي
- [ ] I make plans and stick to them
  أنا أضع الخطط وألتزم بها
- [ ] I get chores done right away
  أنا أنجز الأعمال المنزلية على الفور
- [ ] I follow through with my plans

أنا دائما أتابع خططي

- [ ] I always finish what I start
أنا دائما أنهي ما أبدأ

* **18. Please select that applies to you**

يرجى تحديد ما ينطبق عليك

- [ ] I leave my belongings around
أترك متعلقاتي ملقاة حولي
- [ ] I leave a mess in my room
أترك فوضى في غرفتي
- [ ] I dislike routine
أنا أكره الروتين
- [ ] I usually waste my time
عادة ما أضيع وقتي
- [ ] I find it difficult to get down to work
أجد صعوبة في جعل نفسي أعمل
- [ ] I tend to postpone decisions
أميل إلى تأجيل القرارات
- [ ] I have difficulty starting tasks
أجد صعوبة في بدء المهام
- [ ] I need a push to get started
أحتاج إلى دفعة للبدء
- [ ] I frequently forget things
كثيرا ما أنسى الأشياء

* **19. Supervisors (or if you have subordinates)**

أو اذا كنت ترأس بعض الأشخاص(للمشرفين)

- ○ I am a supervisor
أنا مشرف
- ○ I am not a supervisor
أنا لست مشرفًا

Employees Workload Assessment Survey

استبيان تقييم عبء العمل للموظفين

Supervisors (or if you have subordinates)

للمشرفين (أو اذا كنت ترأس بعض الأشخاص)

* **20. Do you feel that the number of employees in your team is sufficient for the workload required to be accomplished by your team?**

هل تشعر أن عدد الموظفين في فريقك كاف لاعباء العمل الموكلة إليهم؟

- Extremely sufficient
  كافي جداً
- Very sufficient
  كافي
- Moderately sufficient
  كافي بشكل معتدل
- Slightly sufficient
  كافي بعض الشيء
- Not at all
  غير كافي

* **21. Is the work accomplished on time by your team?**

هل ينجز فريقك العمل في الوقت المحدد؟

- Always accomplished on time
  دائماً في الوقت المحدد
- Usually accomplished on time
  عادة في الوقت المحدد
- Sometimes accomplished on time
  في بعض الأحيان
- Rarely accomplished on time
  نادراً
- Never accomplished on time
  لا ينجزه في الوقت المحدد

*** 22. What is the reason for work delays?**

ما هي أسباب تأخير العمل؟

- [ ] Insufficient number of employees
عدد الموظفين غير كاف
- [ ] Incompetent employees
موظفين غير أكفاء
- [ ] Multitasking
تعدد المهام
- [ ] Lack of planning and time management
قلة التخطيط وادارة الوقت
- [ ] Time consuming activities (unnecessary activities)
المهام المستهلكة للوقت (المهام الغير مهمة)
- [ ] High workload
كثرة أعباء العمل
- [ ] Other (please specify)
يرجى التحديد(غير ذلك)

*** 23. Since the 2015 restructure, do you feel that the workload on the employees has changed?**

هل تشعر بأن أعباء العمل قد تغيرت بعد إعادة الهيكلة في عام 2015؟

- ○ Drastically increased
زادت بشكل كبير
- ○ Increased
زادت
- ○ About the same
لم تتغير
- ○ Decreased
قلت
- ○ Drastically decreased
قلت بشكل كبير

* **24. Did your team (or department) used to complete their tasks faster before 2015 (only answer if you joined before 2015)?**
هل كان ينجز فريقك مهامه بشكل أسرع قبل إعادة الهيكلة في عام 2015 (أجب إذا انضممت قبل عام 2015)

- Much slower
  أبطأ بكثير
- Slightly slower
  أبطأ قليلا
- About the same
  لم يتغير
- Slightly faster
  أسرع قليلا
- Much faster
  أسرع بكثير

* **25. After the restructure in 2015, were there any changes in the process of work assignment to employees?**
بعد إعادة الهيكلة في عام 2015 هل كانت هناك أي تغييرات في عملية تعيين المهام للموظفين؟

- Yes
  نعم
- No
  لا

* **26. How long did it take for these changes in the process to be implemented?**
كم من الوقت استغرق تنفيذ هذه التغييرات في العملية؟

- 1-2 weeks
  من أسبوع إلى أسبوعين
- 2-4 weeks
  2-4أسابيع
- 4-6 weeks
  4-6أسابيع
- 6-8 weeks
  6-8أسابيع
- more than 8 weeks
  أسابيع8أكثر من

* **27. Were the changes made to the process effective with the new number of employees?**

هل كانت التغييرات التي تم إجراؤها على العملية فعالة مع العدد الجديد للموظفين؟

- Strongly agree
  موافق بشدة
- Agree
  موافق
- Neutral
  حيادي
- Disagree
  لا أوافق
- Strongly disagree
  لا أوافق بشدة

*** 28. What do you suggest to improve your team's efficiency?**

ماذا تقترح لتحسين كفاءة فريقك؟

Employees Workload Assessment Survey

استبيان تقييم عبء العمل للموظفين

Demographic Information

المعلومات الديموغرافية

* **29. What is your gender?**

الجنس؟

- Male
  ذكر
- Female
  أنثى

* **30. What is your age?**

العمر؟

- 20-29 years old
  20- 29 سنة
- 30-39 years old
  30- 39 سنة
- 40-49 years old
  40-49 سنة
- 50 -60 years old
  50 – 60 سنة

* **31. What is your position?**

ماهي وظيفتك؟

- Technician/surveyor
  مساح/فني
- Engineer/architect
  معماري/مهندس
- Assistant Manager
  مساعد مدير
- Manager
  مدير

* **32. What is the nature of your work?**

ماهي طبيعة عملك؟

- Onshore (office)
  مكتبية
- Onshore (site or plant area)
  مواقع ، ومصانع(ميداني)
- Offshore
  بحرية(ميداني)

* **33. Years of experience?**

سنين الخبرة؟

- 0-5 years
  0-5سنين

- 5-10 years
  5-10سنين
- 10-15 years
  10-15 سنة
- 15-20 years
  15- 20 سنة
- More than 25 years
  سنة25أكثر من