

**A SYSTEM DYNAMIC APPROACH IN HUMAN RESOURCE PLANNING IN OIL
AND GAS INDUSTRY**

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CANDIDATE'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

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DEDICATION

Dedicated to my parents, Rastam Tan Bin Abdullah and Fatimah Binti Iman and to my siblings, Ahmad Danial Bin Rastam Tan, Darwina Bt Rastam Tan and Dahlia Darwisya Bt Rastam Tan. Not to forget, the best friend of mine, Mohd Hasyim Bin Mohd Ali.

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ABSTRACT

This study deals with the factors that affecting the Human Resource Planning in Oil and Gas Industry. In this research study, a relationship between two factors such as Production Rate and Mobility Rate will be the change factors that can affect the outcome or output in this study as it related with the research objective of this research which is to study the factors affecting the Human Resource Planning. This research study will demonstrate the capability of the System dynamics modeling to model the human resource planning involving with some elements that can be as an important factors that can affect the planning of human resource in the oil and gas company. The developed causal loop diagrams are then will be translated into stock flow diagram model by inserting the data that can be calculated into each variables of Flow, Stock and Converter involved. The developed Stock Flow Diagram is then used to run the model for further analysis which it can help in achieving the objective of this research study. In fact, this model can be implemented in various industry as well as it will help the Human resource Manager or Project Manager to forecast the actual workers needed to be hired to perform a task and achieved the goal or objective of the organization in terms of the production rate for example.

TRANSLATION OF ABSTRACT

Kajian penyelidikan ini berkaitan dengan faktor-faktor yang mempengaruhi Perancangan Sumber Manusia dalam Industri Minyak dan Gas. Dalam kajian penyelidikan ini, hubungan di antara dua faktor seperti Kadar Pengeluaran dan Kadar Mobiliti akan menjadi faktor perubahan yang boleh menjejaskan hasil atau output dalam kajian ini kerana ia berkaitan dengan objektif kajian penyelidikan ini iaitu untuk mengkaji faktor-faktor yang memberi kesan kepada Perancangan Sumber manusia. Kajian penyelidikan ini akan menunjukkan keupayaan pemodelan Sistem Dinamik untuk model perancangan sumber manusia yang melibatkan beberapa elemen yang boleh menjejaskan perancangan sumber manusia dalam syarikat minyak dan gas. Rajah gelung sebab dan akibat maju akan diterjemahkan ke dalam stok aliran model rajah dengan memasukkan data yang boleh dikira ke dalam setiap pembolehubah Aliran , Saham dan Penukar yang terlibat. Yang maju Saham Aliran Rajah kemudiannya digunakan untuk menjalankan model untuk analisis selanjutnya yang ia boleh membantu dalam mencapai objektif kajian penyelidikan ini. Malah , model ini boleh dilaksanakan dalam pelbagai industri dan juga ia akan membantu Pengurus Sumber Manusia atau Pengurus Projek untuk meramal kuantiti pekerja sebenar yang perlu diupah untuk melaksanakan tugas dan mencapai matlamat atau objektif organisasi dari segi kadar pengeluaran sebagai contohnya.

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CHAPTER 1

INTRODUCTION AND GENERAL INFORMATION

1.1 INTRODUCTION

This research study focuses on how Human Resources Planning is conducted in Oil and Gas Company in Malaysia. Generally, this study will look at the relationship between the factors that affect the Human Resource Planning that may influence the effect on the shortage or excess number of employees in the organization. Besides, as a contribution to Project Management Areas, this research will also develop several strategies that can be used by a Project Manager in order to overcome an unwanted issues or challenges that may be faced in the planning of the manpower nowadays or even in a future.

In this chapter, there are several elements that will be discussed further in more detail in order to help the success of this research study. The first element will be the Background of Study which it will focus on the typical issues that commonly happen in Human Resource Planning that can be as a backbone of this research study. Secondly, Problem Statement will be focused on the problem that may be faced by the organization such as the impact of shortage and excess of the employees on the performance of the organization. Next elements that will be discussed are the Research Objective and Research Questions as these two elements that has an interdependencies with each other that will be the primary guide for this research study. Research Scope will be specified so that the study will always be on a right track and confusion and error can be avoided in order to provide a positive outcome at the end of this study. The sixth elements in this chapter will be the Significance of Study which it will focus

on the impact and effect of this research study to the manager involved, organization as to the various industry as well as it can be a valuable knowledges to be learnt in a lifelong. Next, Expected result will be the outcome that need to be achieved by conducting this research study and at last but not least, will be the Conclusion to conclude all elements that has been discussed to provide the readers with an initial ideas and better understanding on what this research is all about.

1.2 BACKGROUND OF STUDY

1.2.1 Human Resource Planning.

Human Resource Planning is one of the process involved in an overall Human Resource Management Theory (Loosemore et al., 2003) which it has been implemented widely in various emerging industries such as Business, Engineering, Medicine, Science and Oil and Gas as well. Since 1970s, many organization has realised the existence of Human Resource Planning that need to be well managed in their organization as it can definitely give a positive impacts currently and in the future as well. Besides, it is also one of the important processes that must be implemented by the organization to ensure there is an enough or an appropriate number of employee to be used at the righ time and at the right place (Zeffane and Mayo, 1994). This process definitely is a right things to do when there is a need for an organization to recruit a new employee based on the demand or supply of the workforce that may change from time to time according to a particular situation occur in the industry or even in the organization itself.

Parker and Caine (2006) defined Human Resource Planning as a personnel tool that help the organization to have a right number of manpower with the right quality in a right time and places. It is vital to have a right number of manpower that can be derived based on the forecasting of the demand and supply of the organization in a short or in a long term as well as this can help the organization to plan the human resources needed based on different period or phase to avoid the unwanted situation or issue of shortage and excess of manpower in theor organization. By having a right number of manpower at the specific time to execute the productionn tasks, it may help

the organization to increase their performance and the productivity as they can achieve the strategic objectives and goals very easily.

According to Lunenburg (2012), a good Human Resource Planning is an involvement between 2 different elements which are to meet current and future personnel needs. This is when the organization need to forecast the number of the employees needed to achieve the objectives and goals set by the organization that may satisfy the desired quantity and quality of the staff as well. The planning of the workforce inside the organization can help the top management to monitor and manage the flow of an employees into, through or even out of organization in ensuring an equilibrium between current and future needs of the quantity and quality of staff can be easily achieved.

In Human Resource Planning, the forecasting demand is one of the phase that need to be conducted by the top management of the organization. It can be defined as a method to determine the number and type of personnel that will be needed by the organization at some particular period in a future. It is very important to conduct this process as it will be as the initial analysis or projection that can be used by the organization to ensure the shortage and surplus of the workforce at some particular time can be avoided.

1.2.2 Factors affecting Forecasting Demand

There are some elements or factors that must be taken into consideration when the organization need to plan on their workforce in forecasting demand such as the productivity of the organization and the rate of mobility of the employees (Zeffane and Mayo, 1994) as there can be the uncertainties or changes factor that may affect the recruitment of an employee.

The above statement has been agreed by Lunenburg (2012) as he stated that the demand for the product or service provided by the organization is paramount when forecasting future personnel needs. Not just that, but, he added that other factors that is usually being considered by the organization in forecasting the demand of the personnel is the turnover due to resignation, terminations, transfer and retirement. Hence, this research study will be focusing on these two factors that represent the

change factors that may affect the Human Resource Planning that can answer the first objective of this research study as well.

The first factor affecting the forecasting demand in Human Resource Planning is a demand rate as it can be defined as a rate on maximum amount that a customer desire to purchase any product or service in the organization. The rate of demand demanded by customer will influence the production of the product or service that need to be achieved which these elements can help in forecasting the demand of the workforce at some point in a future. It is vital for the organization to have an enough quantity of the workforce inside the organization by referring to both demand and production rate of the product or service that must be produced by the production department of the organization.

The second factor will be the mobility rate as it can be defined as a measure of how many employees are transferring in and out of the organization due to some other supported factors. It can be influenced by referring to several supported factors such as retirement, resignation, termination, promoting and transferring to another branches or department as well. All this supported factors may affect the demand forecasting of the workforce inside an organization that must be taken into consideration as the mobility or movement in and out of the workforce can result to a shortage or surplus of the quantity of the employees that supposedly needed by the organization in some particular time and place in a future.

1.2.3 Process Involved in Human Resource Planning

Human resource planning consist of several process that must be conducted in sequence order to ensure the successful of the planning. The process can be illustrated in the Figure 1.1 below:

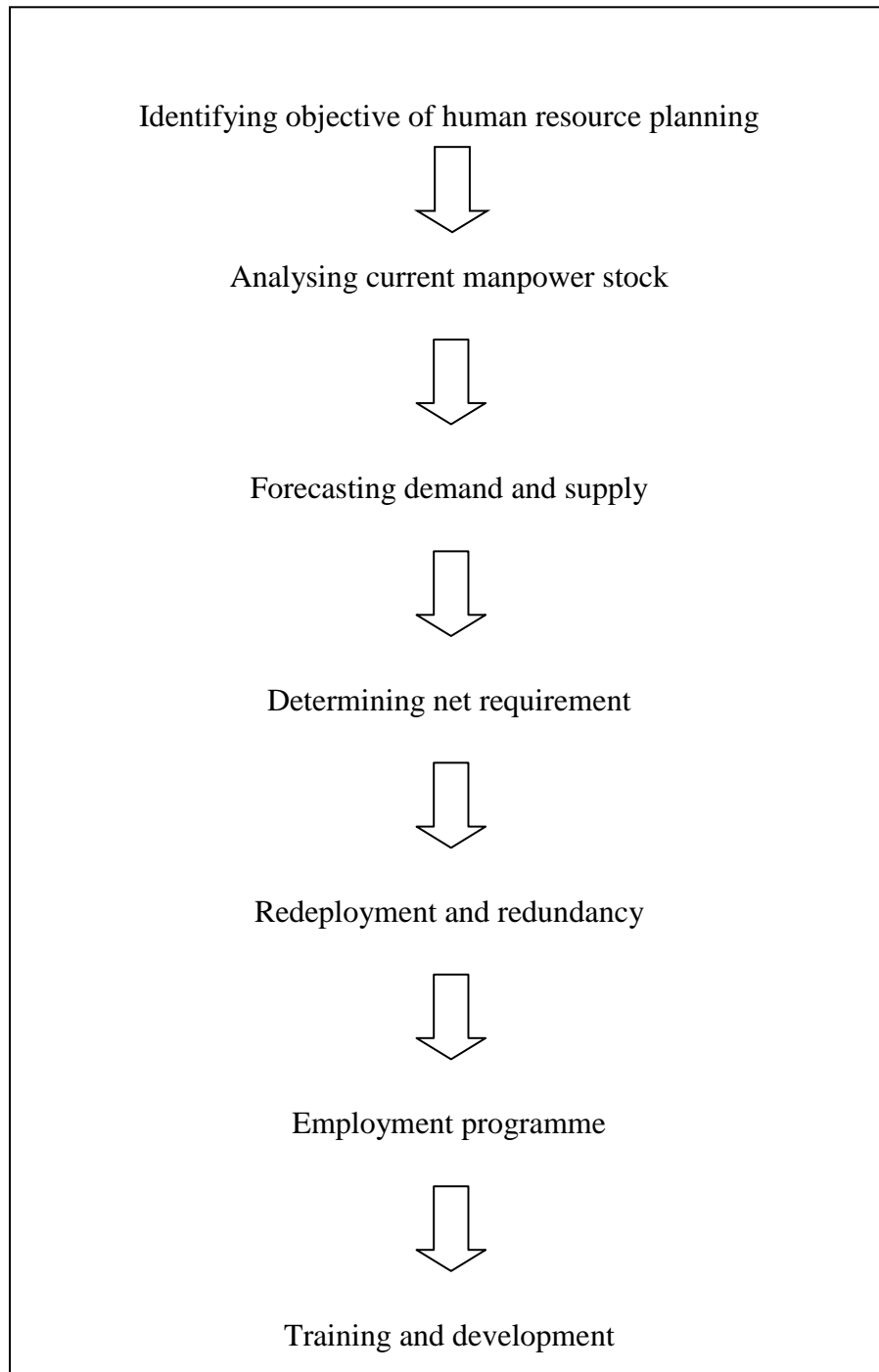


Figure 1.1 : Process of Human Resource Planning

- 1) Identify the objective of Human Resource Planning.

The organization need to identify and clarify the objective of Human Resource Planning on what they wanted to achieve in a future that must be matched with the strategic objectives of the whole organization.

- 2) Analyse the current manpower stock.

Current number of manpower inside the organization must be continuously analysed and being updated to make the planning of human resources become much easier and errors can be avoided in forecasting the supply of manpower.

- 3) Forecast the demand and supply.

The organization must forecast the demand and supply of manpower in term of quantity and quality in monthly or yearly in each department. All factors that may influence the forecasting of the demand and supply of organization must be considered.

- 4) Determine net requirement.

The organization need to determine the differences between the demand and supply of workforce to make a right decision in determining the quantity and quality of workforce to be employed.

- 5) Redeployment and Redundancy.

In this process, surplus employees will be given a choice whether agreed to be transferred to another department that required an extra employee or being offered with the voluntary retirement scheme that benefited them for a long term.

6) Employment Programme.

The organization must develop further process of Human Resource Management such as Recruitment and Allocation, Training and Development, Performance Management, Salary Welfare Management and Labor Relationship Management.

7) Training and Development.

In this process, the organization need to prepare a training and development programme for the employees in order to acknowledge them of their actual tasks and roles and to enhance and increase the knowledges, skills, abilities and other characteristics needed to perform their job.

8) Evaluation of Human Resource Planning.

The organization have to evaluate the Human Resource Planning that has been implemented according to the outcome whether it is effective to be implemented in the organization or not. If not effective, changes have to be made to the Human Resource Planning so that it is reliable to be used to the organization.

1.2.4 Issues in Human Resource Planning

There are some issues arise in the planning of Human Resource in the organization. The manager involve in the planning of their workforce usually will unlikely to conduct a process that can make them to realize better on how they can avoid an unwanted situation when they have no enough number of employees to be used in that particular time in order to achieve a mission or objective of the organization. This will definitely bring a problem to the organization as they will have to delay their production process due to insufficient employees that supposedly to be hired by the organization in early planning of their workforce by taking some factors

into consideration to avoid an unwanted situation that will decrease the profits of the organization as well.

Besides, it is very important for the manager to forecast the number of employees that supposedly available in the organization by analysing factors that may affect the number of actual employees in that organization which it may result to an insufficient number of employees that supposedly to be used. Hence, the manager have to predict and forecast the actual number of employees that must be hired in initial recruitment by taking some factors into consideration when they conduct their planning of their workforce. Not just that, but, if they succesfully considering these factors into the planning of the workforce, they will have no problem to conduct a recruitment session for a second time that may incur a lot of costs to conduct it to ensure that they have an enough employees to be used in their organization to produce products as demanded by the customer.

1.3 PROBLEM STATEMENT

It is vital for the organization to have an early awareness on the number of their workforce to avoid them for having a shortage or surplus of the number of employees that may result to a project delay or there will be not enough products to be delivered to the customer on time. Hence, this research study will help the organization to reduce the staff gap to become zero between the differences of the actual number of employees and the number of employees that wanted to be hired. If the manager manage to minimize the staff gap as well as manage to reduce it to zero, it shows that the organization is on the right track where the actual numbers of employees needed to perform tasks or to produce products as being demanded based on the production rate is equal to the number of employees that is being hired by the organization. It is very important to have equal number of employees in both aspects as it will prevent the organization to incur any extra costs that may result to a high loss to the organization.

1.4 RESEARCH OBJECTIVE

There are 3 research objectives that can be gained in this proposed research study which are:

- 1) To study relationship between factors that affect the Human Resource Planning and the surplus or shortage of the employees in Oil and Gas Company.
- 2) To develop a System Dynamic Model on the Human Resource Planning in Oil and gas Company.
- 3) To suggest several strategies for a better Human Resource Planning in Oil and Gas Company.

1.5 RESEARCH QUESTION

There are 3 research questions that can be developed based on the research objectives of this proposed research study. There are included as following:

- 1) What is the relationship between factors that affect the Human Resource Planning and the surplus or shortage of the employees in Oil and Gas Company?
- 2) How to develop a System Dynamic Model on the Human Resource Planning in Oil and gas Company?
- 3) What are the several strategies for a better Human Resource Planning in Oil and Gas Company?

1.6 RESEARCH SCOPE

The research scope of this research study can be listed as following:

- 1) Oil and Gas Company in Malaysia.
- 2) Human Resource Department in Oil and Gas Company in Malaysia.
- 3) Production Rate and Mobility Rate as the factors that affect the Human Resource Planning in Oil and Gas Company.

1.7 SIGNIFICANCE OF STUDY

This study is very beneficial and has its own significance to Project Management Industry as Human Resource is one of the 9 areas in Project Management Body of Knowledge that must be well understood and well managed by the Human Resource Manager, Project Manager and the top management of an organization as well. Human Resource is a very important areas that need to be well managed as the performance of the organization or project is influenced by that particular areas.

This research study with a title of 'A System Dynamic Approach in Human Resource Planning in Oil and Gas Company' may contribute a very wide knowledges and understanding on the planning of human resources in one of the challenging industries which is in Oil and Gas Industry, which can be analysed from various factors that will be collected from the feedback gained from the selected company. Hence, this research study is vital to the Human Resource Manager as it can help to increase their knowledge and understanding by referring to the feedback based on the real situation and experience faced by the Oil and Gas Company existed in Malaysia.

A System Dynamic Model that will be developed in this research can actually open up the mind, viewpoint and perspective of Human Resource Manager or Project Manager which cover all the issues throughout the company in 360 degrees. Besides, the strategies that will be suggested as the possible outcome that can achieve the third research objective of this study which it may help them to overcome any challenge, issues or unwanted situation that can occur in managing the human resources in their organization which it can damage the reputation and the image of the organization as well.

1.8 EXPECTED RESULT

Every research study that will be conducted must be expecting a good and positive result or outcome that is beneficial to others. Basically, the expected result that will be gained at the end of this research is based on the research objectives that will be proposed in this study. In this research study, the relationship between factors that may affect the planning of human resources and the shortage or surplus of the

employees that will be developed by using a System Dynamic will be expected at the end of this research which it will give more understanding and various knowledges on how to forecast the actual number of employees that needed by the organization based on the important factors that may influence the results. Besides, by conducting this research study, several positive strategies can be used and implemented in a real scenarios of an industry is also one of the expected result or outcome that can give advantages to the manager and the top management of organization as well together with the best solution that may overcome the unwanted situation such as insufficient or excess of employees needed by the organization in conducting production process in their organization. Besides, the outcome may help in improving a Human Resource Management to be more better in a future.

1.9 CONCLUSION

In this chapter, it explained the general ideas of this research study including the Introduction, Background of Study, Problem Statement, Research Objective, Research Question, Research Scope, Significance of Study and Expected Result as an early understanding to the readers about the research study with a title of ‘A System Dynamic Approach in Human Resource Planning. The objectives of this study as stated in the Reserach Objective will be as the primary guide, direction, basis and the backbone for this whole research. The next chapter is very important in this study as it will discuss further on the Literature Review based on the opinion or perspective from various author related to this research study.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Literature Review is a compulsory that must be developed in a research study as it will be the backbone of the research itself. It consist of the important elements that need to be discussed in order to give a better understanding and provide more knowledges to the readers. Usually, Literature Review will be developed by referring to the previous past research that has been conducted before as it can provide supportiveness to a current research that will b e conducted. This can generate more ideas on how to conduct a better research that can be used in the future by the young generations. This chapter will be focus on the Literature Review by reviewing the literature or information of several important elements related to this research that need to be discussed further such as the Application of System Dynamic, Human Resource Planning and Human Resource Planning in Oil and Gas Company.

2.2 APPLICATION OF SYSTEM DYNAMIC APPROACH

A methodology called as System Dynamic approach was designated by a research named Prof. J W Forrester in the late of 1950. In 1958, he succesfully published his classic book named “Principal of Systems” and had invented numerous of models of industrial problem as a guide in overcome the issue or problem that occured in management industry (Durgun S.M., 2002).

2.2.1 Definition of System Dynamic Approach

Forrester (1961) defined System Dynamics as the investigation of the information-feedback characteristics of managed systems by using a design models to improve the organizational form and guiding policy. System Dynamic is a method dealt with the time-dependent behaviour of managed system with the aim of describing the system and understanding, through qualitative and quantitatives models, how information feedback governs its behaviour, and designing robust informatin feedback structures and control policies through simulation and optimization (Coyle, 1995).

Thelen and Smith (1994) has defined a dynamic theory as a theory of embodied and embedded action. In a simple word, it can be defined as a methodology method that clarified, analysed and discussed all the related in and out of the issue. This methodoly method actually is a process that can result in developing a causal loop feedback that will be investigated through the issue or organization itself in order to overcome the problem that may arise. A system dynamic approach will be started with a large system and at the end of the investigation, it will be downsized to a very small and particular system.

Hao, Hill and Shen (2007) also defined System Dynamic as an approach of a system analysis that responsible in creating a models or a system that represent a model a real world and to study the dynamic behind the system. They added that the system dynamic modelling approach will focus to have a better understanding of the feedback gained from a system that can help a researcher in constructing a variable relationship that consist from different stage and also the existence of the rate variables. This method definitely will ensure the effectiveness of the decision making process in order to make a right decision that can affect a better performance of the organization or it may lead to a failure performance of the organization as well.

Barlas and Diker (1996) stated that a system dynamic methodology is a method or tool that can help in analyzing a problem that may occur in a system or inside the organization. It can be used by converted the elements involved in that particular into an interactive simulation software after completing the construction of the System Dynamic Model. This researcher have the same opinion with Hao, Hill and Shen as they agreed that in this system dynamic model, the variables will be chosen wisely and

will be used in the decision making process as it can give a positive result as the outcome of the research study.

Clarks (1990) defined System Dynamic as a studying process of using implementation of the use of a system which a model, exploration and explanation will be constructed. This must be executed to construct a dynamic model which it can give a better understanding by focusing on the behaviour of a variables consist in a system of an organization surrounded by a close loop diagram. Hence, all the elements will be observed in just that particular area.

2.2.2 Benefit of using System Dynamic Approach

The feedback gained to develop a causal loop feedback will used a face to face communication which the manager and the model will sit together and expanding an arised issue in order to accomodate as many variable or factor as they can. Not just that, but the system dynamic approach will be as the easiest guide in order to answer the research question of the conducted study by receiving the information via feedback which it will start from the developing of causal relationship, then followed by the analysis between various factors consisting of the causal feedback loop (Liu, Long & Xue, 2012).

Besides, system dynamic model is different and much better methodology compared to other methodology because it can deal with a complicated non-linear system., and it is said fit to study the social economic system which it may consist of various issue, background, factors from internal and external, and also involved with several parties as model feedback. In addition, the system dynamic approach is said as the practical system lab, which it has the ability in carrying out the simulation process by using the model simulation analysis system. This method can help it users in getting a richer and more profound information in order to find the very best solution and way to solve the problem and it is virtually the process of problem solving optimization process, and its ultimate goal is to find a system optimal structure, in order to achieve the better system function (Liu, Long & Xue, 2012).

2.2.3 Process of System Dynamic Model

There are a few methods or steps that can be used and being implemented in constructing a System Dynamic Model as it was a continuous process in ensuring the success of this type of methodology. The invention of a dynamic model process is to ease a manager that is going to implement this type of problem solving in solving existed problems occurred in the system of the organization.

Randers (1980) has developed a four-step process in a System Dynamic Model. The steps including Conceptualization, Formulation, Testing and Implementation. This steps started with a conceptualization of a problems occurred in a system. A manager need to produce a specific purpose on why he or she need to implement a system dynamic model. The identification of the several indicators must be developed in listing a variable involved. In formulation stage, a manager need to consider all thje variables that have been identified and develop a relationship between the variables in finding the cause and effect relationship. Testing will be developed to the test reliability and the effectiveness of the model that has been developed before implementation of a model will be developed after a positive outcome is gained in previous stage. It is important to follow the sequence or order of this procesds in getting the best outcone at the end of a process.

However, Barlas and Diker (1996) has concluded that System Dynamic Methodology is consist of 5 process which is Problem Description, Model Conceptualization, Model Construction (Simulation Model), Verification and Validation of a model and Simulation Experiments. It is actually similar with a process that has been developed by Randers but, the process development seems to be more difficult and need to consume more time to verificate and validate the model as no article that can be agreed that verification anf validation of a model can help in getting a 100% of accuracy of the model.

2.3 HUMAN RESOURCE PLANNING

Human resource planning is an initial and mutual step that must be implemented in an organization. The planning of human resources is vital to any organization that use the workforce or human resources as their main resource to

execute many types of activity or process in order to achieve the goal and objective of the organization. Gilley (2002) stated that Human Resources can be defined as labor or the people who carry out business or work for an organization. Human Resource Planning is a process of identifying the numbers of employee, the types of employee skill and developing a plan to ensure that the appropriate workforce is available to provide quality services. (Loosemore et al.2003). It is absolutely important to identify and analyse the demand needed by the organization to fit for the job position and the supply for the qualified workforce based on the KSAOs which are knowledge, skills and other characteristics. The demand needed by the organization must be analysed and predicted initially so that the shortage of the workforce can be avoided that it may interrupt the business activities of the organization.

Brush and Ruse (2005) stated that human resource planning enable the organization to decide more effectively what actions or investments the institution should take to align its overall strategy and talent management processes with operational requirements, determine more effectively the type talents needed to execute institutional strategy and operational requirements, determine more effectively the number of people needed over the term of institution's strategic and operation plan which it requires assesing the capabilities of the current talent pool and identifying the capacity that will be required in the future and at last but not least is to identify talent gaps and priorities more effectively and determine the best approach for closing the gaps by looking at their relative size.

However, Mohanty and Deshmukh (1997) has listed some drawbacks of human resource planning. For example, stated that human resource planning is a very large complex and unstructured decision making process, due to the lack of full information relating to manpower problems and issue as the business environment is dynamic and uncertain. This is because several changes may occur rapidly manpower problem that alligned with the current condition of economic and the standard of living that rise from time to time and also due to an existing of a very high degree of uncertainty in operationalizing the outcomes of a manpower planning process due to the organization's internal behavioral dynamics.

Several research has been conducted before in studying the human resource planning but in another industry. Little research has been conducted in oil and gas industry but, the dimension or factor that want to be investigated is just the same. Based on the study conducted in higher education institution, Samer (2010) stated that the results of the study indicate that based on participants' perceptions, the higher education institution under study have a strong level of Human Resource Planning. Examples of Human Resource Planning that has been implemented include identifying sources of relevant employment and workforce data, establishing competency models, training internal talent, updating and ensuring the accuracy of all job descriptions, and establishing organizational learning practices that encourage employees to engage in lifelong learning.

Another study of human resource planning which has been conducted in hospital, Robert (2008) stated that the results of the content analysis of the responses suggest that in a majority of hospitals the human resource specialists perceive the main functions of their departments to be recruiting and dismissing the workers, doing various kinds of statistical analysis, processing the data for social and health insurance companies and filling the personal records of hospital employees.

2.4 HUMAN RESOURCE PLANNING IN OIL AND GAS COMPANY

Oil and gas industry was one of the most important industries in Malaysia as it became the second largest contributor to the economic of Malaysia. Thus, the government has put a lot of effort in focusing to promote and enhancing this industry by the help of the human resource ministry in developing a human resource planning in oil and gas industry. In this industry, a lot of workforce must be used in a team in order to execute some processes in producing oil and gas.

In Malaysia, Petronas is the main company that producing oil and gas to Malaysia. They had developed a human resource planning in their company to analyse the demand needed by their company with the supply of the workforce in this industry due to the low wage of salary and also due to the safety and health matter. This issue will turn out to be a problem when there is a high demand by the industry but with a low supply of the workforce that has the knowledge, skills and other

characteristics needed in this industry. Hence, this is very important for the oil and gas company to develop human resource planning in their company so that they have the competitive advantage to compete with their competitors in getting the best workforce that can increase the performance of their company.

2.5 CONCLUSION

In a nutshell, this chapter focusing on the literature review that has the interrelation of the Application of System Dynamic and Human Resource Planning. The definition of some term involved in this research has been discussed based on the opinion of past researcher that have done their research in a System Dynamic or in Human Resource Planning. All the elements involved has been divided into several subtopics to give a better understanding and easier to be referred to. A reliable data has been used in quoting the quota of previous researchers is based on the secondary data which are journals and journals articles.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

System dynamic is a tool that is widely used by many researchers nowadays that has been invented by Professor Jay W. Forrester in late 1950 because of its effectiveness in analysing a very complex system and problem occur in any organization or in various industries as well. It is very helpful to any manager in the organization that has particular problems to be solved as this tool will narrow down the problems into very specific and small parts which it will become easier to find the main cause of the problem. This can save time, energy and cost of the top management in solving the existed problem in their organization.

Not just that but, one of the benefits of using System Dynamic is it can help the manager to have a better understanding of the overall problem by viewing internal and external factors that can be derived from the inside or outside of the organization that may influence the problem. It can provide an advantage to the organizations as they may find something new that can be negative or positive matter that they have never think it before as it can bring loss or profit to the organization.

In this chapter, it will explain about the methodology used in this research study in order to gain a positive result as the outcome that want to be achieved in this study. The methodology then will be divided under several subtopics such as Data Source and Data Collection, Components of System Dynamic, Building Block of System Dynamic, System Dynamic of Modelling Process and Data Analysis. Besides, in this chapter, a Stock and Flow Diagram and Causal Loop Diagram will be shown

and discussed in more details as it will be the backbone of this research based on the feedback gained from the data collection medium that has been used in this study.

3.2 DATA SOURCE AND DATA COLLECTION

In a research study, data source and data collection can be said as a vital elements that must be executed wisely in order to get reliable information that can help in completing the research. All the data collection must be reliable and collected from a right source to avoid any unreliable that can lead to a negative outcome at the end of the research.

There are 2 popular data sources that is widely used in collecting data such as Primary Data and Secondary Data. Primary data can be defined as the data that is observed or being collected directly from first-hand experience or from its original sources such as observation, survey, and interview, which a researcher can observe and experienced by them of the condition in the workplace or any activities occur in the surrounding of the organization. Whereas, secondary data can be defined as the data that will be collected from other parties, other sources or data that has been published in a writing form such as journal, journal article, book, magazines, newspaper and many more. This data can be referred many times as it will constant and remain the same even though time has changed.

3.2.1 Primary Data: Interview

In this research study, both of the data source and data collection that has been explained earlier will be used. The primary data will be collected by using interviewing method with the Human Resource Manager from the Oil and Gas Company which is the main scope of this research study. The manager will be interviewed in order to get feedback that can help to gain a reliable outcome in this study as it based on the real situation that occur in their workplace area. The manager can identify several internal or external factors that involved directly or indirectly in managing the Human Resource Planning of his or her organization and he or she can help in developing some strategies that can help to achieve a better performance of the organization. Their feedback also can help in developing the Stock and Flow Diagram together with a Causal Loop Diagram as various elements or factors can be added in

the diagram, and as a result, a complete diagram can be presented as the outcome of this research study.

3.2.2 Secondary Data: Journal, Journal Article, Internet Article

The second data source and data collection that will be used in this research study is a Secondary Data which various journal articles, journals, books and internet articles that contained all information about Human Resource Planning, Human Resource Planning in Oil and gas Industry and the Application of a System Dynamic can help in developing and getting a reliable outcome of this research. Besides, the comparison between various past researches can help in identifying some internal and external factors that affecting the Human Resource Planning which can lead to a development of Causal Loop Diagram. This type of data source can give a better understanding to the researcher because it can be referred many times if the researcher are having a problem to understand the contents but as the drawback, it sometimes cannot provide and updated or the latest information based on the current situation as it may change from time to time and as the result, it may be not reliable to what really happen nowadays.

3.3 COMPONENTS OF SYSTEM DYNAMIC

System dynamic can be defined as an interaction between subsystems which there is an interrelation between the variables or factors involved in a particular system. It is a methodology that able to manage a complex feedback system which it can result in a positive outcome at the end of this research. System Dynamic has several components which it will integrate and cope with each other in order to produce a correct result such as Cause and Effect, Causal Loop Diagram and Feedback Loop.

3.3.1 Cause and Effect

Cause and Effect is the vital factor needed in using a system dynamic. It can help the organization to create a better understanding of the whole system such as the cause of behaviour pattern occurred and the effect of behaviour pattern to the employees or to the organization as well. Usually, the elements or factors of the cause

will result to the positive or negative effect to the whole system which it can be gained from a feedback of the organization that has a problem in their system. The cause and effect is also a set of variable or component that can produce a Causal Loop Diagram.

3.3.2 Causal Loop Diagram

A Causal Loop Diagram can be defined as a simple map of a system with all its constituent components and their interactions. It can be used as a medium to reveal the structure of a system in order to analyse a system's behaviour pattern over a period of time. The behaviour pattern involved in a system will integrate and cope with each other to produce a complete system dynamic model because all the internal and external factors that will be analysed can be seen in a broader and deeper view to gain a correct result at the end of this research study.

3.3.3 Feedback Loop

Another component of a System Dynamic is a Feedback Loop which it then can be developed as a continuity of Causal Loop Diagram. A Feedback Loop can be defined as a close sequence of cause and effect with the existence of positive and negative sign in the Causal Loop Diagram. These two feedbacks with different sign will result differently according to their strength of influencing the factors listed in a Causal Loop diagram. Their integration will influence the result of the research study which it will be either positively or negatively effect as the impact to the employees or to the organization as well.

3.4 BUILDING BLOCK OF SYSTEM DYNAMIC

The implementation of System Dynamic used in this research study will use the internal and external factor in the planning of the human resources with a constant rate which it will be the data standards in this study. All the variables and factors will interact and integrate with each other that can lead to a modification in the overall behaviour of a system which it can be referred as a Dynamic Behaviour.

A dynamic behaviour can be shown and illustrated as in figure 1, which it involved the relationship of the inflow and outflow of water from a bath tub as a result of the dynamic behaviour of a system. System Dynamic can be used as a tool to

investigate the behaviour of variables or factors either it internally or externally to the organization. Besides, System Dynamic can help to a better understanding on how a complex system can behave over time and result in a behaviour pattern.

Usually, System Dynamic can be graphically represented by Stocks (boxes), Flows (thick arrows) and Causal Diagrams (thin arrows). A stock will represent the elements or factors that can be measured or accumulated, and it is regulated by the flows. A Flow act as a variable that can determine the rate of influx or efflux from the Stocks. All the element or factors will be represented as a variable and when all the variables integrate with each other that may influence the system that will be represented by a Causal Diagram.

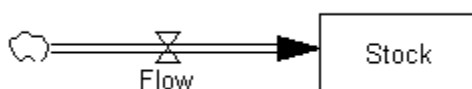

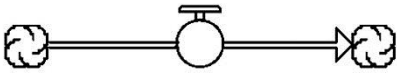

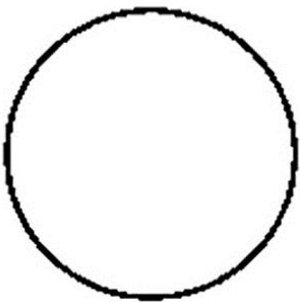


Figure 3.1 : Illustration of Dynamic Behaviour

System dynamic can bring many advantages that could encourage the researchers to adopt that kind of method implementation, there are also many drawbacks or negative impact that could inhibit from using this methodology. In this methodology, the researcher will have an interest to investigate how these variables, plus the increase or decrease of a constant rate could interact and behave over time, creating a new situation that could change the researcher's perception about the standards implementation problem.

As a System Dynamic is a set of tools that can be used in order to help understanding of complex systems, this strategy is said can help to identify and explain the complex behaviour related to the use of constant rate, by using the adopter on its system structure. By learning about the behaviour of this complex system, the advantages and drawbacks related to the adoption of using constant rate can be identified and resulted in a positive outcome that can be used in a future.

Below is the Building Block of System Dynamic that has been illustrated in a box diagram according to a System Dynamic Software, ITHINK.

Shape	Name	Purposes
	Stock	Stocks are accumulations. They collect whatever flows into them, net of whatever flows out of them.
	Flow	The job of flows is to fill and drain accumulations. The unfilled arrow head on the flow pipe indicates the direction of positive flow.
	Connector	The job of the connector is to connect model elements. There are two types of connector: the action connector and the information connector. Action connectors are signified by a solid, directed wire. Information connectors are signified by a dashed wire.
	Converter	The converter serves a utilitarian role in the software. It holds values for constants, defines external inputs to the model, calculates algebraic relationships, and serves as the repository for graphical functions. In general, it converts inputs into outputs. Hence, the name "converter."
	Decision Process Diamond	The Decision Process Diamond (DPD) is a mechanism for managing the diagram complexity associated with the representation of decision processes within your models. With DPDs, we can "bury" the intricacies of the decision

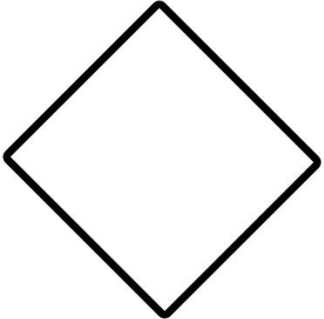
		<p>rules that drive the flows into a "black box". On the surface, the users of the models can clearly see both the inputs and the outputs associated with a decision process. When the need arises, the users can "drill down" into the detail of the decision process itself. As a result, the models can maintain a bi-focal perspective, displaying the macro- and micro-structure as needed.</p>
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Figure 3.2 : Illustration of Building Block of System Dynamic

3.5 SYSTEM DYNAMIC MODELLING PROCESS

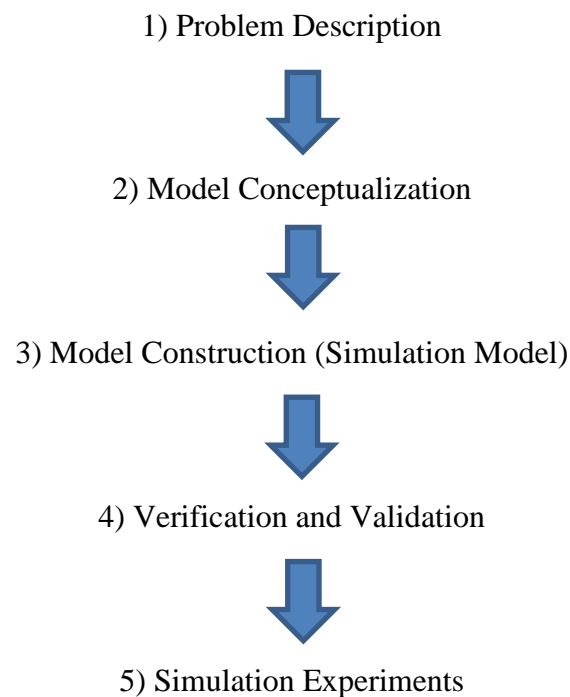


Figure 3.3 : 5-Steps of System Dynamic Process (Barlas & Dicker, 1996)

System Dynamic Modelling is one of the suitable methods to manage a very complex feedback system. It gives a clear picture by identifying and analysing all the factors related in a particular system or problem occurred in the organization. The system dynamic modelling involved with a several components that has been illustrated in a figure above. It is basically the same with the system dynamic modelling process which all five components must be developed in a right sequence or in a right order.

The first step involved in this process is a Problem Description which a problem occurs in a system or in the organization must be identified and described with detailed information in order to ease a manager in analysing a root cause or the factors involved in a problem. A problem can be identified by using an observation method that is widely used in a problem solving method.

The second step in developing a system dynamic modelling is a Model Conceptualization which a purpose and the scope of the model will be identified. It is important to have a feedback because it can help the researcher to gain a reliable result as the feedback is based on the real situation that happened in a real organization. In this research study, the feedback can be gained by using an interviewing method with the Human Resource Manager of Oil and Gas Company as a data collection method in order to identify all related factors that can influence and affect the planning of the human resources of their organization. The Human Resource Manager is responsible in identifying and answering any factor or question related that may help in achieving the objectives of this research study.

Thirdly, the Simulation Model Diagram or known as System Dynamic Model must be developed by using a cause and effect that has been identified in a previous step. By developing this diagram, a clear picture of real situation can be seen and analysed broader and deeper as the integration between various factors will be shown in this diagram. A simulation diagram is actually very strongly related to the cause and effect feedback as the identification of the factor or cause and the effect involved in a system will be used in developing a simulation model as it will be developed in a systematic and as an overall system that can be investigated in order to achieve the possible positive outcome at the end of this research study.

The fourth step in developing the system dynamic modelling process is the Verification and Validation of a simulation model or a feedback loop diagram which it can be defined as a close sequence of cause and effect with the existence of positive and negative sign in the Causal Loop Diagram. A feedback loop diagram also involved with an arrow of different colours to show both positive and negative sign of the cause and effect. Usually, there will be a constant factor or constant rate that can be the influence to the potential adopter at the left side of diagram which indicates the positive sign or the adopter at the right side of a diagram which it will be the negative sign of the indicator. This step will be repeated by replacing another factor as the constant rate that has been identified in the feedback of the cause and effect.

The fifth step is the Simulation Experiments which all the variables collected by using a data collection method will be inserted to simulation software to be experimented in order to gain a result as the outcome of this research study. It will be the indicator of the success of this research study.

3.6 DATA ANALYSIS

In this research study, the data will be focused on the two factors that will be identified by the interviewee which is the Human Resource Manager that actually happen in his or her organization. The data collected in this research study by using an interview method will be analysed by using a simulation method with the aid of the computer software. The data will be inserted to simulation software that can be quantified via quantitative data analysis that can give a clear result on the relationship between the cause and effect variables listed in a Causal Loop Diagram. This analysis of data can help the researcher in providing a better strategy in order to improve the current situation in the workplace area of the organization involved in this research study.

A simulation method will be used in this research study by using computer software that can analyse all the factors or variables involved in a system dynamic. The variables then will be inserted into a mathematical analysis or model that can help in producing a positive outcome or result at the end of this research study.

3.7 CONCLUSION

As a conclusion, this chapter will be discussed on the methodology used in using a system dynamic model. Several components of system dynamic has been identified which it will be the backbone of this research study in order to gain a positive result as the outcome of this research study. Besides, in this chapter, a Causal Loop Diagram is developed in order to create a better understanding of a big picture by studying and analysing the integration between the subsystem or various factors involved in this research study. The interviewing method also has been used in order to gain a feedback in identifying the cause and effect occurred in the real situation of the organization related to a problem of the research study which several of the research objectives can be achieved successfully.

CHAPTER 4

DATA ANALYSIS

4.1 INTRODUCTION

Data Analysis is the most important chapter in the research study. It explained on how the expected results can be achieved based on the data collection that has been collected. In this chapter, subtopic such as Causal Loop Diagram, Stock Flow Diagram, Model Verification, and Data Analysis will be discussed in more detail.

Besides that, this chapter focused more on the effects of several changes such as production rate and mobility rate towards the human resource planning in a project. These changes will effect the need to increase or decrease the workforce according to the changes mentioned before. From the simulation output, we can predict the right number of workforce to be hired or to be laid off based on the result of surplus or shortage of the workforce. Hence, thi study can help the Human Resource Manager to make a better decision on whether to increase or to decrease their workforce so that the right number of workforce can be used in the right time and at the right place.

4.2 CAUSAL LOOP DIAGRAM

Causal Loop Diagram or known as Influence Diagram is one of the parts in a System Dynamic Model which the diagramming aids can help the researcher to understand and visualize how different variables in a system are interrelated with each other. Narahari and Narasimha (2009) stated the primary purpose of Causal Loop Diagram is to present a structure of model development in an aggregate form. This is to give a better and clear understanding for the researcher in communicating the

feedback through the involvement of the relationship between all variables as there are being influenced or will influence each other.

Causal Loop Diagram is a group of variables that has been linked together in a connected path. The diagram consist of elements and arrows which these two will be linked together by including a sign of + or – on each link which all the variables can determine whether the feedback loop is either negative or positive.

In this research, the Causal Loop Diagram of Human Resource Planning that has been developed is based on two different factors which are Production Rate and Mobility Rate as it will be the change factors that can affect the outcome or output in this study as it related with the research objective of this research which is to study the factors affecting the Human Resource Planning. Each factors will be represented by each cycles that will be linked together by some variables involved in the planning of human resources. Hence, in this research, there will be two cycles contained in this causal loop which are Production Rate and Mobility Rate as it can be shown in Figure 4.1 below :

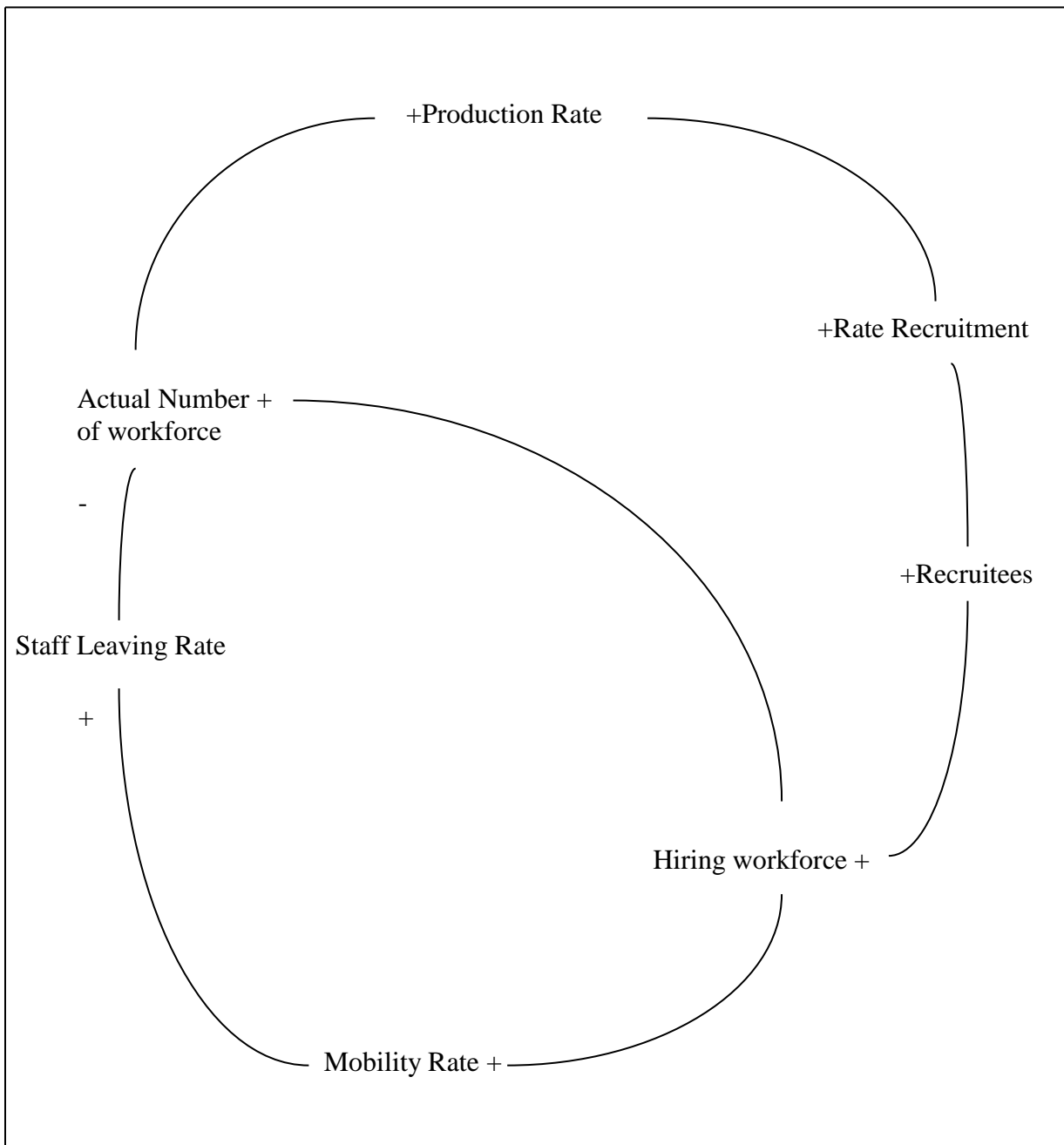


Figure 4.1: Causal Loop Diagram of System Dynamic Model in Human Resource Planning.

4.2.1 Loop 1: Production Rate

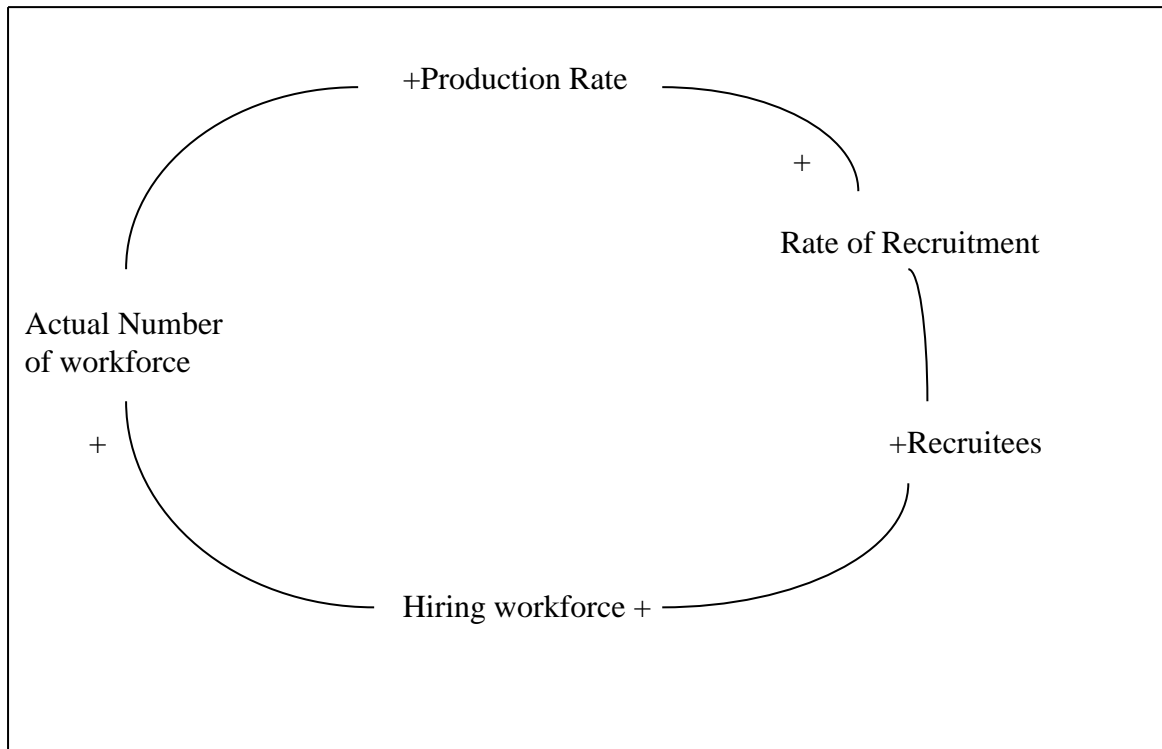


Figure 4.2 : Causal Loop of Production Rate

Causal Loop	Feedback Loop	Factor:
+Production rate =>+ Rate of recruitment =>+ Recruitees =>+ Hiring workforce =>+ Actual number of workforce	Reinforcing	Production rate

Table 4.2: Summary of elements in Causal Loop of Production Rate

Figure 4.2 shows the cycle that represent the Reinforcing loop. This cycle can show the relationship between production rate with the planning of the workforce whether there will be shortage or surplus. In the process of Human Resource Planning, the manager will start the process by estimating the 'Production rate' that must be achieved by the organization based on the demand of customer. The increasing of the

'Production rate' may increase the 'Recruitment rate' of the organization as they have to add more employees to the current number of employees to ensure that they will be an enough employees to operate and fulfill the mission of the organization that is represented by 'Production rate'. Next, the manager have to analyse the 'Recruitees' or supply of qualified workforce that has qualification to be recruited by the organization based on the knowledges, skills, abilities, expertises and other characteristics demanded by organization. In this process called as recruitment, the organization may have to recruit a high number of 'Recruitees' compared to the 'Rate of recruitment' as it will give a high option and selection of 'Recruitees' that can be hired in the hiring process after they have undergo several tests and interview that has been prepared by the Department of Human Resource. Hence, a high number of 'Hiring workforce' will effect to the increasing of 'Actual number of workforce' that is available in the organization required in fulfilling the mission and goals of the organization.

4.2.2 Loop 2: Mobility Rate

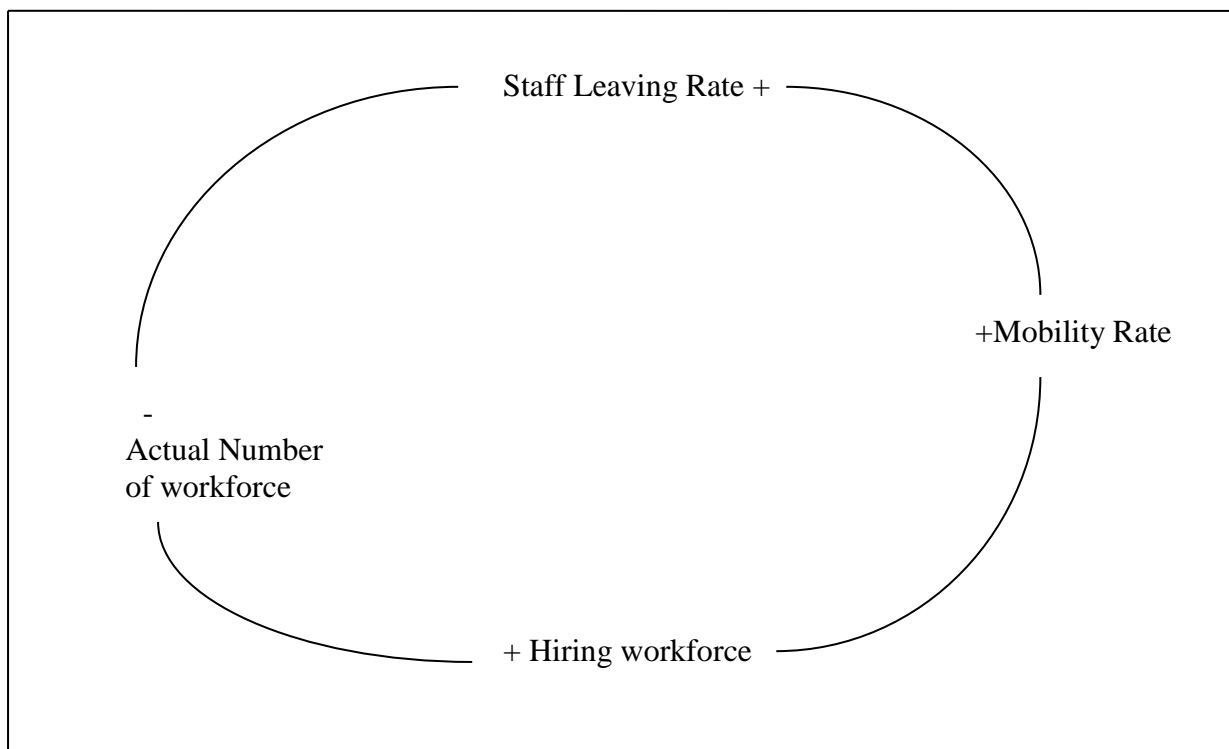


Figure 4.3: Causal Loop of Mobility Rate

Causal Loop	Feedback Loop	Factor:
+Mobility rate =>+ Staff leaving rate =>-Actual number of workforce=>+Hiring workforce	Balancing	Mobility rate

Table 4.3: Summary of elements in Causal Loop of Mobility Rate

In Figure 4.3, the cycle represent the Balancing loop. This cycle can show the relationship of mobility rate with the number of workforce whether there will be shortage or surplus of workforce available in the organization. In this cycle, the manager have to estimate the ‘Mobility rate’ of their current employees that available in the organization based on the number of employees that undergo resignation, retirement, transferring and termination as it may affect the rate of staff leaving or entering the organization as well. However, the increasing of ‘Mobility rate’ and ‘Staff leaving rate’ will turn out to decrease the ‘Actual number of workforce’ available in

the organization. Hence, it will affect the 'Hiring workforce' to be increased in order to make sure that there will be an enough employees required to fulfill the objective and mission of the organization.

4.3 STOCK AND FLOW DIAGRAM

Stock and flow diagram is one of the important diagramming aids in System Dynamic Model. It help in developing the relationship s between all the variables that have the potential to change over some period (Narahari & Narasimha, 2009). The diagram can represent the information of flow structure in the system which it consist of 3 importantl elements such as Flow, Stock and Converter. Flow can be used in filling and draining the accumulations that will accumulate in a box named as Stock which it can be inflow or outflow. Stock is used in collecting the flows into them and the flows out of them whereas the converter will act as a changes factor that convert input into output.

The developed causal loop diagrams are translated into stock flow diagram model by inserting the data that can be calculated into each variables of Flow, Stock and Converter involved. The developed Stock Flow Diagram is then used to run themodel for further analysis which it can help in achieving the objective of this research study. The Stock and Flow Diagram of System Dynamic Model in Human Resource Planning that has been developed in this research is shown in the Figure 4.4:

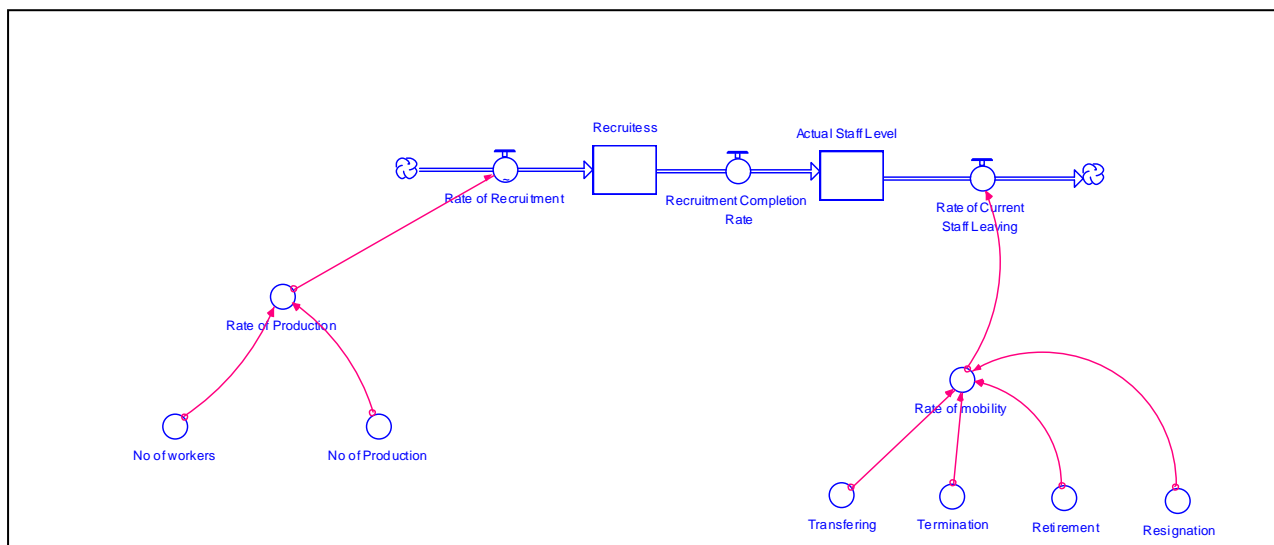


Figure 4.4: Stock and Flow Diagram of System Dynamic Model of Human Resource Planning.

The developed Stock and Flow Diagram shows the process of recruiting the workers that need to be hired in the oil and gas company. It also act as a backbone of this stock and flow diagram which it is need to be conducted by a manager that wanted to know how many actual workers that need to be hired to fulfill the mission of the organization that can be affected by the rate of production that need to be achieved and also by a mobility factor.

From Figure 4.4, the stock flow diagram is start from a flow of 'Rate of recruitment' connected to the stock of 'Recruitees'. The data for the flow of 'Rate of recruitment' is derived from the converter of 'Rate of production', which it act as a change factor that can influence the output of this study. To get the data of 'Rate of production', two other converters, which are 'Number of workers' and 'Number of production' has been connected to it via connector. The multiplication of these two converters will be the amount that is going to be accumulated into the stock of 'Recruitees'.

At stock of 'Recruitees', the amount of data will be drained out through the flow of 'Recruitment completion'. It then will enter into the stock of 'Actual number of available employees'. In this stock, the data will be accumulated. At last process, the amount of data in the stock of 'Actual number of available employees' will be drained out through the flow of 'Rate current staff leaving'. A converter of 'Mobility rate' which it represent the change factor that influence the shortage or surplus of employees is connected to the flow of 'Rate current staff leaving'. To get the data for the converter of 'Mobility rate', the summation of 4 converters that represent 'Transferring', 'Termination', 'Resignation' and 'Retirement' respectively will be connected into that converter.

In real organization, the manager supposedly to recruit more person compared to the staff needed to be hired to fill in the job vacancy if the selected recruitees did not want to involve in that recruitment process due to the uninterest or they have been working at other company. The recruitees is then will be selected in the process of recruitment completion rate which we have to refer back to how many workers that supposedly to be hired in the recruitment rate process. After the recruitees has been qualified to be hired is selected according to the specific knowledges, skills, expertises needed by a company in a recruitment completion rate, there will be a surplus or shortage of the recruitees that need to be hired that will lead to an actual staff level in that organization by adding the number of current workers with the number of workers that need to be hired by that organization.

However, the factor of Mobility rate which consist of the number of workers that exit the organization through retirement, resignation, termination and transferring will happen in the process of current staff leaving rate will affect the actual staff level and this must be considered in the first process of recruitment rate at the very beginning of the human resource planning.

The stock and flow diagram has been developed in the logic order or sequence so that there will be some changes to the stock whether it will increase or decrease by depending on the converter and the flow connected to each other. All this elements is interdependence with each other in order to get a valid result at the end of this reseach study.

A data has been collected through an interview that has been set up with a Human Resource Manager can be inserted to a software of System Dynamic in order to analyse the data to get the result or output that can answer the objective of this research study. Based on the interview, the data for converter of 'Production rate' for the organization is 30 by dividing the converter of 'Number of product' produced with the converter of 'Number of workers' in that company. For the converter of 'Mobility rate', the manager assumed that the rate of mobility of the workers is only 5 due to the reason of being transferred to another branches of their company and also through resigning and retirement. However, the rate is quite small and it does not affect so much on the human resource planning of that organization. For the flow of 'Rate of recruitment', 60 has been derived from the addition of the converter of 'Number of current workers' in the organization with the converter of 'Production rate'. The rate of recruitment can make the manager aware of the needed extra workers that need to be hired to achieve the production rate for the company.

Some of the data has been generated by the manager by using his consideration and there is no historical data that has been referred to. Besides, the number of the data that has been collected has been rounded off to make the calculation become more easier and more precise to be analysed.

4.4 MODEL VALIDATION & VERIFICATION

Model Validation and Verification is a vital process that need to be performed in all simulation model in order to ensure the model that has been developed can be used in a real project, organization, company or even in a real industry. It can be defined as a method to evaluate of wether or not a product, service, process or system complies with a regulation, requirement, specification or imposed condition. This method of evaluation is compulsory for the researcher in obtaining the accuracy, correctness or the truth of any information inside a model after it has been developed by using a Literature Review that has been discussed in previous chapter. Usually, the verification method is involved with two different parties which are the interviewer or researcher who conduct the research study and also the respondent or the interviewee who has a right and competent skills, experiences and knowledges that can provide the

answer, give various feedback and can verify the model according to his or her expertises and experiences in their own organization or project.

In this research study, the causal loop diagram is developed based on information collected through reviewing past research (Literature Review) verified by the Human Resource Manager of the Petrol Gas Company located in Jalan Haji Ahmad. The purpose of this verification activity on the causal loop diagram as shown above is to verify each factors, variables or elements involved in that causal loop diagram is similar and relevant to what has been used and existed in their organization in terms of the planning of the human resource or workforce. It also one of the method to obtain various data needed to fill in each of the factors, variables and elements inside the causal loop diagram.

As a result, the Human Resource Manager of Petrol Gas Company has made some considerable correction and improvement to improve the causal loop diagram to be more relevant suitable with his opinion on managing the workforce of the company. Some of the factors in the causal loop diagram is not exist in the Human Resource Planning of the company but the manager managed to give feedback or data based on his expertises and experiences. Despite having some elements to be repaired and replaced, the interview was successful and the final design of the model has been formed.

The verification of the 'Actual staff level' has been verified similarly to the actual organization which the number of actual staff is recorded monthly at the beginning of the month because if there is a resignation from the staff, it must be done at the end of every month. Secondly, the verification of the staff gap has also been verified agreeely by the manager which the result of the staff gap will be achieved by the difference between the target staff level and the actual staff level.

The verification of 3 elements such as recruitment rate, recruit completion rate, present staff leaving rate showed that all the elements is not practically being used as the manager did not recorded or calculated any rate for the elements and only the number of the staff involved in that particular elements only. For the target staff level, the manager usually forecast the level of the staff according to the peak time and also according to the size of the project and it will not be recorded as monthly which is not comply with the causal loop diagram that has been developed.

Finally, through some on going discussion, the manager finally verified the causal loop diagram that has been improvised earlier based on his expertises and experiences who has been working with that company as a Human Resource Manager for about 6 years. The project manager also emphasize on how to plan a human resource which undergo a production rate and mobility rate which it will be the factors that can affect the actual workers that need to be hired based on the demand and supply of the workforce.

4.5 DATA ANALYSIS

This section discusses the results from the developed system dynamic model. In this subtopic, we are going to analyse the result of the data that has been collected. Data analysis is the peak for this research study that can determine whether the system dynamic model that has been developed earlier in previous chapter is answering the research objectives or not. The data that has been collected through interview method with the Human Resource Manager has been inserted into a stock and flow diagram via using Ithink Software to be analysed.

To analyse the result of the data, we are going to relate with the first objective of this research study which is to study what are the factors that affecting the Human Resource Planning. As been discussed before, there are two factors that will be the change factors that affect the planning of human resources that act as a converter that influence the flow to be accumulated into the stocks. The first factor that will be analysed is the Production rate that act as a converter that will affect the rate of recruitment that act as a flow which it will accumulate the amount of employees that need to be hired by the organization. Hence, supposedly the increasing of the rate of recruitment due to the increasing of the production rate is expected to increase the number of employees that need to be hired as the output of this study. The developed system dynamic simulation model is run for 12 month as the manager can analyse the result collected in each month in order to see the number of employees available in the organization.

Below is the result of the data that has been collected:

Months	Total Number of Recrutees
1	30.0
2	60.0
3	90.0
4	120.0
5	150.0
6	180.0
7	210.0
8	240.0
9	270.0
10	300.0
11	330.0
12	360.0

Figure 4.5: Simulation Output for Recrutees

Based on the Figure 4.5, it shows that the initial number of employees that already available in the organization is 30 for the first month. By considering the Production rate for each month is 60, the result shows that the number of employees started to increase as well as it being affected by the rate of recruitment that has been influenced by the rate of production. Hence, the total employees that need to be recruited by the organization at the end of the year is 360 employees. It is because, the number of recrutees is the stock which accumulate the Rate of recruitment that has an inflow direction into it. So, the number of recrutees is increasing constantly.

This definitely answering the first objective of this study which is the Production rate does affected the number of recrutees that need to be hired by the organization to ensure that the Production rate can be achieved by the organization to

deliver the products to the customers on time. Hence, it is very important for the manager in considering the production rate that need to be achieved by the department of production in ensuring that there will be enough employees to execute the task or production process to produce end product to be delivered to the customer.

A manager must forecast the production rate for their organization in order to have an initial estimation of the employees that need to be hired. The value of the production rate is not necessarily to be constant for each month as there will be a month that the organization need to produce the products in a very high amount due to the increasing demand of the customers that can be called as “Peak Time”. The organization must take a wise decision in choosing whether to increase the number of employees which, if they add more workers, it may increase the cost of the hiring cost but it will not affect the morale and motivation of the employees as well as the quality of the products or services that need to be delivered to the customer can be increased.

The second option is that, if they did not increase the number of employees that need to be hired that may decrease the motivation and morale of the employees as well as the quality of the products or services may be affected and they will fail to deliver the products to the customer on time as been contracted. Besides, if the organization worry that they have to incur a high cost of hiring if they decided to add more employees, they can hire a Part Timer only during peak time which the production rate will be higher and they may have to increase the number of production that may be achieved by each worker in that organization.

Next, the analysis will be conducted regarding the data that has been collected based on the second factors that may affect the planning of the human resources which is the Mobility Rate. Supposedly, increasing of the Mobility rate will affect the increasing number of actual number of employees available in the organization. The result can be shown in the Figure 4.6:

Months	Total Number of Actual Employees
1	45.0
2	70.0
3	95.0
4	120.0
5	145.0
6	170.0
7	195.0
8	220.0
9	245.0
10	270.0
11	295.0
12	320.0

Figure 4.6: Simulation Output for Actual Number of Employees Available in The Organization.

Based on the figure 4.6 above, we can see that the actual number of employees should be available in the organization after considering the mobility rate is increasing for each month. The actual workers that need to be hired initially is 45 employees by considering the mobility rate for each month is 5. At month 12, the total employees that supposedly available in the organization after it has been influenced by the rate of staff leaving the organization is 320. Hence, it is necessary for the manager to consider how many staff that will left the organization due to the reason of resignation, retirement, transferring and termination so that, they will know the actual employees that supposedly to be available in the organization. Hence, it answered the objective of this study which is the rate of mobility of the employees does affected the planning of the human resources in an organization.

It can be concluded in the hypothesis of the higher the mobility rate, the higher the present staff leaving rate which it then will increase the rate of recruitment which it can be derived from the stock and flow diagram, which the mobility rate is being connected by a connector into a stock of rate of recruitment. The stock will accumulate the new number of recruitment that need to be recruited in each starting activities of Human resource Planning. It is vital to the manager to think the aspect of mobility rate which connected to a present staff leaving rate as to ensure that there will be not enough of the recruitees to be recruited if this type of aspect is not being calculated and considered as it will affect the time to do the recruitment process as the manager needed to do the second recruitment process all over again which it will cause a delay in performing or finishing their production task. Hence, this will definitely affect the performance of the organization as the whole as well.

A manager must forecast the rate of mobility of the employees such as by identifying the number of the employees which the age of the employees that suitable to retire or interest of the employees to resign or to terminate their recruitment if they already received another offer from other company. It is vital for the manager to consider all these factors in order to acknowledge the manager of how many employees that should be replaced with a new employees. Hence, this can give an early acknowledgement and warning to the organization as well as they can notify the reason why the employees wanted to resign or terminate their contract maybe due to the problem of salary or even problem that occur in their workplace that can make the employees feel demotivated to continue working at their organization. If this problem can be notified and can be solved earlier, it also can affect to a decrease of the staff leaving rate.

Next, the analysis between the two stocks which are the Number of Recruitees and the Number of Actual Employees that available in the organization can be conducted. However, in the Figure 4.7, another column that represent the difference between the Number of Actual Employees and Number of Recruitees or it can be called as Staff Gap has been added. By looking at the differences between these two stocks, we are able to identify whether there is a shortage, supply or equal number of employees available in the organization.

Months	Total Number of Actual Employees	Total Number of Recruiters	Staff Gap (Total Number of Actual Employees - Total Number of Recruiters)
1	45.0	30.0	15.0
2	70.0	60.0	10.0
3	95.0	90.0	5.0
4	120.0	120.0	0
5	145.0	150.0	-5.0
6	170.0	180.0	-10.0
7	195.0	210.0	-15.0
8	220.0	240.0	-20.0
9	245.0	270.0	-25.0
10	270.0	300.0	-30.0
11	295.0	330.0	-35.0
12	320.0	360.0	-40.0

Figure 4.7: Staff Gap (The difference between Total Number of Actual Employees and Total Number of Recruiters)

Based on the Figure 4.7 above, we can see that at month 1, 2 and 3, there is a surplus number of employees by 15, 10 and 5 respectively. This shows that the number of employees that is hired are higher than the actual number of employees that supposedly available in the organization. However, at month 4, it shows that the organization is on the right track when there is an equal number of employees that is hired and the actual number of employees that supposedly available in the organization. It is very important for the organization to reduce the staff gap to zero which it can avoid an unwanted situation that can occur such as the shortage and excess of employees in a particular time. This can be as a strategy that can be developed and suggested to help in a better planning of the human resources in a future that may achieve the third objective of this study as well. At month 5 to month

12, there is a shortage of the employees by -5, -10, -15, -20, -25, -30, -35 and -40 respectively. This shows that the number of employees that is hired are lower than the actual number of employees that supposedly available in the organization. Hence, we can conclude that the organization will face a problem of insufficient of employees that need to be used to execute a production process that may cause the end products can not be delivered to the customer on the exact time. This is the reason that can support the importance of a good planning of human resources that must be conducted initially at the early planning before the recruitment activities can be conducted by considering the factors that affect the planning of the human resources such as the Production rate and the Mobility rate.

The data that has been analysed has shown clearly that in some duration, the workers need to be hired and to be laid off to fulfill the demand of the rate of recruitment which it lead to a number of actual workers that need to be have in order to ensure the production of the organization can be maximised in a long term. So, the manager can forecast the duration that he or she need to do the human resource planning at the right time so that there will be no problem of shortage and surplus of the workforce based on the Production rate and Mobility rate.

Based on the analysis of data that has been discussed previously, there are several strategies that can be suggested to help a manager in conducting a better Human Resource Planning in their project as it will answer the third objective of this research study as well. One of the strategies that can be used by a manager is by hiring a part timer when the organization need to add their workers to achieve the production rate such as during peak time as it does not incur a high cost compared to hiring workers permanently. A contract must be binded with the Part Timer as a confirmation that they will be available for the organization anytime the organization wanted them to work.

Not just that, but, the organization can implement the policy of which the workers can add and maximise their workload voluntarily which it give a mutual benefits to the employee and the organization as well. The employee can have an opportunity to increase their amount of salary and to prove to the organization that they have a good performance and productivity that is suitable to be promoted to a higher level. At the same time, the organization can achieve their production rate and

deliver the product to the customer on time which it may increase the loyalty of the customer that lead to a repetitive purchasing.

A manager also need to play their role at their very best in persuading or motivating the workers to stay in the organization. A good relationship and communication between the manager and the employee also can help to decrease the staff leaving rate or tunover to another company. If the employee work with a new employers, it will give such a big loss to the former organization as the employee may reveal the competitive advantages of that organization in term of technology used in production process for example. This can give the new employer a chance to imitate the technology to be used in their product. A manager may conduct a 'Face to Face' approach or 'Slow Talk' approach with the employees that wanted to leave the organization and try to remotivate them with a good rewards so that they can continue in contributing their services to the organization.

4.6 CONCLUSION

In a nutshell, this chapter focusing on the result of the data that has been analysed by using a Stock Flow Diagram. We can conclude that the organization involved faced a problem of shortage and surplus of the workforce. This problem can be overcome by reducing staff gap between the differences of Total Number of Actual Employees and Total Number of Recruitees. Besides, by analysing the data that has been collected, the strategies is then be developed that can help the manager in conducting a better human resource planning in their organization in a future.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

In this chapter, some discussion about what this research is all about will be discussed briefly. It will give readers a better understanding on the problem background of this research and how the output can answer the objectives of this research. Besides, discussion on the limitation of this study will also be included. Not just that, but some recommendations will be recommended and suggested to the other researchers that interested in doing a future research study related to the area of Human Resource.

5.2 DISCUSSION ON PROBLEM BACKGROUND

This research study has demonstrated the capability of the System dynamics modeling to model the human resource planning involving with some elements that can be as an important factors that can affect the planning of human resource in the oil and gas company. In fact, this model can be implemented in various industry as well as it will help the Human resource Manager or Project Manager to forecast the actual workers needed to be hired to perform a task and achieved the goal or objective of the organization in terms of the production rate for example.

It is more cleverer and wiser if the manager can predict the rate of mobility which can decrease or increase the actual workers needed by the organization so that the recruitment and hiring process can be easily undergo as there will be no problem of shortage or surplus of the workforce that may interrupt the completion of the project

and it also can lead to an increasing of the hidden cost that need to be paid for the dummy workers as they have no contribution to the productivity of the organization.

System Dynamic Approach that has been used in this research may provide a better and clearer understanding to the Human Resource Manager and Project Manager as well in planning the human resource or workforce that is vital to the organization. The variables inserted in the model based on the real situation that occur in an organization which produced a data analysis can help in recommending some recommendations and strategies that may be discussed further in the next chapter which it can contribute knowledges to the manager in a wise decision making to be decided that can help to increase the performance of the organization as a whole.

As being discussed in the previous chapter of Introduction, there are some issues arise in the planning of Human Resource in the organization. The manager involve in the planning of their workforce usually will unlikely to conduct a process that can make them to realize better on how they can avoid an unwanted situation when they have no enough number of employees to be used in that particular time in order to achieve a mission or objective of the organization. This will definitely bring a problem to the organization as they will have to delay their production process due to insufficient employees that supposedly to be hired by the organization in early planning of their workforce by taking some factors into consideration to avoid an unwanted situation that will decrease the profits of the organization as well.

There are two factors that must be taken into consideration by a manager in the planning of the workforce such as Production Rate and Staff Leaving Rate as these factors will answer the first objective of this research study. Based on the data analysis that has been conducted by using stock and flow diagram, definitely these two factors has influenced the planning of the human resources in the oil and gas company. This is due to the increasing number of staff that must be hired in order to execute the production process to ensure the production that has been demanded by customer can be achieved in a particular time. Besides, it is very important for the manager to forecast the number of employees that supposedly available in the organization by analysing the staff leaving rate that decreased the actual employees in that organization which it may result to an insufficient number of employees that supposedly to be used. Hence, the manager may use this system dynamic modeling to

predict the actual number of employees that must be hired in initial recruitment by taking these two factors into consideration when they conduct their planning of their workforce. Not just that, but, if they successfully considering these factors into the planning of the workforce, they will have no problem to conduct a recruitment session for a second time that may incur a lot of costs to conduct it to ensure that they have an enough employees to be used in their organization to produce products as demanded by the customer.

It is vital for the organization to have an early awareness on the number of their workforce to avoid them for having a shortage or surplus of the number of employees that may result to a project delay or there will be not enough products to be delivered to the customer on time. Hence, this research study will help the organization to reduce the staff gap to become zero between the differences of the actual number of employees and the number of employees that wanted to be hired. If the manager manage to minimize the staff gap as well as manage to reduce it to zero, it shows that the organization is on the right track where the actual numbers of employees needed to perform tasks or to produce products as being demanded based on the production rate is equal to the number of employees that is being hired by the organization. It is very important to have equal number of employees in both aspects as it will prevent the organization to incur any extra costs that may result to a high loss to the organization.

A system dynamic modeling based on the Human Resource Planning that has been developed by referring to the production rate and staff leaving rate which both of the variables act as a converter that accumulate the value in stocks of the recruitees and the actual number of employees available in the organization derived from the stockflow diagram, it straightly answered the second objective of this research study. This will give a clear and better understanding to the readers as it can show the relationship between all the variables involved in stockflow diagram that interdependent with each other in order to look at the whole process of the planning of the human resources in the organization.

5.3 LIMITATION OF THE STUDY

This research study has its own limitation which it may decrease the effectiveness and efficiency to be used in a real organization. It can be shown in the backbone process of the planning of the human resources as it may not be implied by some organization due to the lack of time needed to execute a recruitment process in their organization. Hence, the backbone process used in this study may be too complex which it may influence the end result or the output that wanted to be achieved by the organization. Supposedly, the organization that interested in using this modeling to forecast the number of employees that need to be hired may adjust accordingly based on their current practise.

Besides, there are only two factors that is being discussed in this research as both factors act as a converter that influence the output of this research. It will be more better to look at more factors that may influence the planning of the human resources as we can vary the output of the model. Hence, the planning of workforce can be looked and can be improved at different views and perspectives to help the manager in managing the workforce in a better way that is good for their own future performance and reputation.

5.4 RECOMMENDATION FOR FUTURE RESEARCH

There are some recommendations that can be made to help in giving some ideas to the researcher that interested in conducting a research based on this study or related with the issue of Human Resource. As we know, there are many process or concept involved in the Human Resource Management rather than Human Resource Planning and hence, the researcher may use the other process involved in Human Resource Management such as Salary, Compensation or others that usually been ignored by the manager in managing their workforce. Besides, some precision may be added and expanding the inputs to the model by taken the information of supply and demand related with the issue of technologies and business knowledge segmentation into consideration. This will definitely improve the performance of the workforce as well as the organization as the technology is widely being used in most of the organization nowadays.

Besides, a combination of the department of Human Resource and other departments also can be contributed in designing a future research in planning of the workforce. It concerning on how the other departments interact with Human Resource department and the implications of their interactions. Grobler and Zock (2010) suggested that the model of the planning of the workforce should contribute to a general issue in a research such as the management and explanation of the cyclical behaviour in any industries. This definitely will bring a system dynamic model in Human Resource areas to the high level of research industry.

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GANTT CHART OF FINAL YEAR PROJECT

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FYP1 ORAL PRESENTATION												
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CHAPTER 5												
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FYP 2 ORAL PRESENTATION												