**ROMBLON STATE UNIVERSITY**

**College of Engineering and Technology**

**Main Campus, Odiongan, Province of Romblon**

**HANDOUT#2**

**MGT 421 ENGINEERING MANAGEMENT MW – 8:30AM – 10:00AM**

**Engr. Reynaldo P Ramos, PhD MF – 10:00AM – 11:30AM**

**QUANTITATIVE MODELS FOR DECISION MAKING**

A model usually refers to a representation of an actual object to a reduced scale, such as a wooden model of a building. It is used to study the behaviour of the actual object. Mathematical models perform a similar function and they represent the actual object or event as a series of mathematical expressions which can be studied further thru the use of computers (programming) due to complexities.

1. **Inventory Models: it is concerned with minimizing the total cost of inventory, or it is referred to “stock control.” It required two principle reasons: to enable items to be built or to be sold, and to act as a buffer against an unpredictable high usage.**

**Types:**

* 1. *Economic order quantity model*: to calculate the number of items that should be ordered at one time to minimize the total yearly cost of placing orders and carrying the items in inventory.
	2. *Production order quantity model*: this is an economic order quantity technique applied to production orders.
	3. *Back order inventory model*: this is an inventory model used for planned shortages
	4. *Quantity discount model*: an inventory model used to minimize the total cost when quantity discounts are offered to the suppliers.
1. **Queuing Theory: it is how to determine the number of service units that will minimize both customers’s waiting time** **and cost of service. The traffic intensity (p) is given by equation:**

p= n/m where: the customers arrive at a rate of n; customers are served at a rate of m

Average number of queue = x2/1 – x; Average waiting time in queue = x/m -n

1. **Network Models: It is used when large complex are broken into smaller segments that can be managed independently.**

**Types:**

* 1. *The Program evaluation review technique (PERT):* a technique which enables engineer managers to schedule, monitor, control, and project tasks and completion of large and complex projects, including organizing complex sequences of tasks. It is also based on the probability of an event occurring at a specified time. A PERT chart presents a graphic illustration of a project as a network diagram consisting of numbered nodes (either circles or rectangles) representing events, or milestones in the project linked by labelled vectors (directional lines) representing tasks in the project. The PERT chart is sometimes preferred over the Gantt chart to clearly illustrate task dependencies.
	2. *The Critical Path Method (CPM):* a network technique using only one time factor per activity that enables engineer managers to schedule monitor, and control large and complex projects. It is a step-by-step project management technique for process planning that defines critical and non-critical tasks with the goal of preventing time-frame problems and process bottlenecks. It is expected that CPM can: (a) define the required tasks and put them down in an ordered (sequenced) list; (b) create flowchart or other diagram showing each task in relation to the others; (c) Identify the critical and non-critical relationships (paths) among tasks; (d) determine the expected completion or execution time for each task; and (e) locate or devise alternatives (backups) for the most critical paths.
1. **Forecasting: It is the collection of past and current information to make predictions about the future. It is an art and a science – it uses scientific tools to help the manager get to an inform guess. Its aim is to provide information for planning and decision making. A forecast tries to define what one believes will happen in the future. A plan defines what one would like to happen in the future, and maps out the activities needed to meet this aim. A forecast feeds into a plan – the plan aims to change the results that the forecast predicts will occur if no action is taken. There are many forecasts produced by the government such as: gross national product (GDP), employment trends, inflation, and other related statistics. It is also used to determine how to allocate the budgets or funds or an upcoming period of time. It also provides an important benchmark for companies which have long-term perspective of operations. “Risk” and “uncertainty” are central factors to forecasting and prediction.**

**Types:**

*4.1 Qualitative forecasting: is based on judgement of past experience and future trends. This is used when data is not available or when past data are unreliable for predicting the future. Examples: (a) Delphi Method – using the judgment of experts to arrive at a convergence regarding the forecast; (b) Scenario Building – the parameters of importance to the company are first recorded and followed by assumptions; (c) Normative relevance analysis – future situation is being forecasted and first assumed, then broken down into a series of steps or items that ate needed to make the forecast happen; (d) Informed judgement or Consensus of Opinion Method – the forecast is done by a group and is based on experience.*

*4.2 Quantitative forecasting/Time Series: it uses time series where past data is extrapolated into the future using a time series.*

*4.3 Quantitative technique using the Causal model: Past data is used to predict the future but it is based on the causal model of cause and effect analysis.*

1. **Regression Analysis: It is a statistical forecasting model that can predict the outcome of a given key business indicator or given variable (dependent variable) on the interactions (describing or evaluating the relationships) of other related business drivers ( explanatory or independent variables). “Simple regression” when one independent variable is involved; while “multiple regression” when two or more independent variables are involved.**
2. **Simulation: It is a method for obtaining information about the system that is being studied and working out, step by step, what happens when customers arrive and go through the service mechanism. They are tedious to implement and require the use of a computer programme.**

*Type: Monte Carlo simulation*

1. **Linear Programming: It is the simplest and most widely used technique for solving problem of utilizing limited resources. The aim is to determine how to meet the desired goals while taking constraints into account. It is also called “linear optimization” to achieve the best outcome (such as maximum profit or lowest cost) in a mathematical model whose requirements are represented by linear relationships.**

**Types:**

*7.1 Graphical Method: It is easy to follow and illustrates the principles involved*

*7.2 Simplex Matrix Method: It is tedious and is best solved by a computer. The principle is the same: all feasible solutions are examined in turn to find the optimum solution.*

1. **Sampling Theory: It is a quantitative technique where samples of populations are statistically determined to be used for a number of processes, such as quality control and marketing research. It is used when data gathering is expensive and it saves time and money.**
2. **Statistical Decision Theory: It refers to the rational way to conceptualize, analyze, and solve problems in situations involving limited or partial information about the decision environment.**