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CONTENTS

ARREST OF A FINITE CRACK WEAKENING AN INFINITE PLATE

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ABSTRACT

In this paper, the problem of a finite hairline straight crack weakening an infinite homogeneous elastic perfectly-plastic plate is considered. The plate is subjected to uniform constant unidirectional tension which is applied to it at infinite boundary. Consequently, crack face open in Mode-I type deformation forming plastic zones ahead of the tip of the crack. To stop the crack from further extension rims of the plastic zones are subjected to normal cohesive cubically varying yield point stress distribution. To visualize the entire physical picture of the problem, the problem is considered in two components which are superimposed afterwards to get the solution of original problem. Westergaard technique is applied to solve the problem. Variation of load required for the closure of plastic zones is studied with respect to the affecting parameters. Results obtained are analyzed and graphically reported.

***Keywords:** Mode I type deformation , Westergaard technique and yield point stress distribution.*

***PACS Nos.** 62.20. Mk; 81.40.Np; 62.20.-x*

INTRODUCTION

Griffith [4] in 1924 was the first one to start the work on straight crack problem using energy balance principle. Milne-Thomson [7] proposed the complex variable technique to solve two-dimensional crack problems using linear theory of elasticity. Dugdale [2] in his model tested the closure of internally cracked plate specimen under tensile conditions, which opens the rims of the crack. Plastic Zones thus formed ahead of crack tip are then closed by normal cohesive uniform constant yield point stress distribution. Dugdale model solution for two unequal collinear hairline cracks was obtained by Theocaris [8]. A modified Dugdale model solution for two collinear unequal hairline straight cracks was obtained by Bhargava, Agarwal and Hasan [1]. Harrop [6] modified the Dugdale model solution for single slit when plastic zones developed were closed by a quadratically varying yield point stress distribution over the rims of plastic zones. Gdoutos [5] calculated stress-intensity factor using Westergaard method. Eftis and Liebowitz [3] worked on the modified Westergaard equations for certain plane crack problems.

In the present paper, an infinite homogeneous elastic perfectly plastic plate weakened by a finite hairline straight crack is subjected to uniform constant tension at infinite boundary. This results in the formation of plastic zones ahead of tips of crack. These plastic zones are closed by normal cohesive cubically varying yield point stress distribution. Principle of superposition and Westergaard hypothesis are used to obtain the analytic solution of problem.

FUNDAMENTAL EQUATIONS

The general method of obtaining the solution to the Dugdale model with an arbitrary power series of stress distribution in the plastic zone follows. The stress function due to the loading in the plastic zones is found from the equation given below

$$\Phi(z)=\frac{2}{\pi}\sum_{j=0}^{j=n}C_j\int_{a_1}^{b_1}\frac{t^j z\sqrt{b_1^2-t^2}}{(z^2-t^2)\sqrt{z^2-b_1^2}}dt,$$

where Cj is constant. (1)

The singular components of $\Phi(z)$ are set equal and opposite to the singular stress function due to remote loading. A relation for the remote applied stress is obtained from this equality. The net stress function then becomes

$$\Psi(z)=\text{non singular terms of}\left(\frac{2}{\pi}\sum_{j=0}^{n}C_j\int_{a_1}^{b_1}\frac{t^j z\sqrt{b_1^2-t^2}}{(z^2-t^2)\sqrt{z^2-b_1^2}}dt\right)$$

The displacement in the y- direction in the plane y=0 is given by $\eta=\frac{2}{E}\mathrm{Im}\left(\int\Psi(z)dz\right)$

where E is Young's Modulus and $\Psi(z)$ is given by equation (2).

The crack opening displacement is given by $\delta_c=\lim_{z\to a}D$

where D is the parting of the crack faces and is equal to 2η

STATEMENT OF THE PROBLEM

An infinite elastic perfectly-plastic plate occupying xoy-plane is weakened by a finite straight crack L: $[-a_1, a_1]$. Uniform constant unidirectional tension, $P_{yy}^{*} = \sigma_{\infty}$, $P_{yy}^{*} = 0$ is applied t infinite boundary parallel to y-axis. This causes opening of the face of crack forming plastic zones ahead of the crack tips. Plastic zone Γ_1, occupies the interval $[-b_1, -a_1]$ while the interval $[a_1, b_1]$ is occupied by the plastic zone Γ_2. Rims of plastic zones Γ_i (i = 1, 2) are subjected to stress distribution $P_{yy}^{\pm} = t^3\sigma_{ye}$, $P_{xy}^{\pm} = 0$. The configuration of the problem is depicted in Figure1.

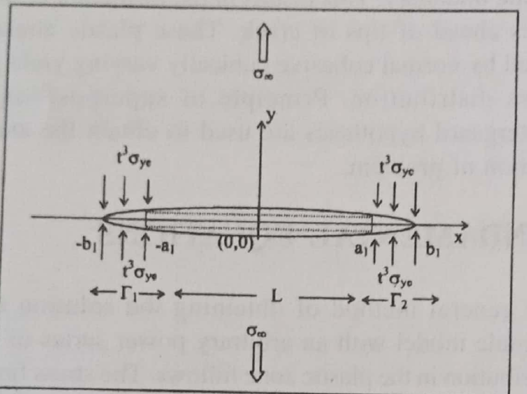

Figure1. Configuration of the Problem

SOLUTION OF THE PROBLEM

Solution of the problem is obtained by superimposing the solution of two component problems, appropriately derived from the original problem. These problems are termed as **Problem I and Problem II.**

STATEMENT AND SOLUTION OF PROBLEM I

An infinite elastic perfectly-plastic plate is weakened by a finite crack L: $[-a_1, a_1]$. Uniform constant unidirectional tension $P_{yy}^{*} = \sigma_{\infty}$, $P_{xy}^{*} = 0$ applied at infinite boundary of the plate opens the face of crack forming plastic zones ahead of crack tips. This can be altered to the case of uniaxial tensile loading by superposition of the stress $P_{yy}^{*} = -\sigma_{\infty}$, $P_{xy}^{*} = 0$. The Westergaard type stress function for the problem is given by

$$\Phi_I(z) = \frac{\sigma_{\infty} z}{\sqrt{z^2 - b_1^2}},$$

where $z = x + iy$ (5)

STATEMENT AND SOLUTION OF PROBLEM II

An infinite elastic perfectly plastic plate is weakened by a straight crack L as defined in Problem I. Plastic zones formed due to unidirectional tension $P_{yy}^{*} = \sigma_{\infty}$, $P_{xy}^{*} = 0$ are arrested by applying cubically varying yield point stress distribution $P_{yy}^{*} = t^3\sigma_{ye}$, $P_{xy}^{*} = 0$, at the rims of crack. The stress function for above forces is given by

$$\Phi_{II}(z) = \frac{2}{\pi}\left(\frac{\sigma_{ye} z\sqrt{b_1^2 - t^2}}{\left(z^2 - t^2\right)\sqrt{z^2 - b_1^2}}\right), \qquad 5$$

where $2b_1$ is the length of the extended crack at any point 't'. Thus the stress function due to the tensile tractions on the plastic zones using equation (1) will be

$$\Phi_{II}(z) = \int_{a_1}^{b_1} \frac{2}{\pi}\frac{t^3\sigma_{ye} z\sqrt{b_1^2 - t^2}}{\left(z^2 - t^2\right)\sqrt{z^2 - b_1^2}}\,dt \qquad 6$$

On solving equation (6) one gets

$$\Phi_{II}(z) = -\frac{2}{\pi}\sigma_{ye} z\left[\frac{\sqrt{b_1^2 - a_1^2}}{3}\frac{\left(2b_1^2 + a_1^2\right)}{\sqrt{z^2 - b_1^2}} + \sqrt{z^2 - b_1^2}\sqrt{b_1^2 - a_1^2} - z^2\cot^{-1}\frac{\sqrt{z^2 - b_1^2}}{\sqrt{b^2 - a_1^2}}\right]$$

Hence, the total stress function for the original problem is depicted by the principle of superposition using equations (5) and (7) and is given by

$\Phi_R(z) = \Phi_I(z) + \Phi_{II}(z)$ i.e.

$$\Phi_R(z) = \frac{\sigma_{\infty} z}{\sqrt{z^2 - b_1^2}} - \frac{2}{\pi}\sigma_{ye} z$$

$$\left[\frac{\sqrt{b_1^2 - a_1^2}}{3}\frac{\left(2b_1^2 + a_1^2\right)}{\sqrt{z^2 - b_1^2}} + \sqrt{z^2 - b_1^2}\sqrt{b_1^2 - a_1^2} - z^2\cot^{-1}\frac{\sqrt{z^2 - b_1^2}}{\sqrt{b^2 - a_1^2}}\right]$$

PLASTIC ZONE LENGTH

Both) $\Phi_I(z)$ and $\Phi_{II}(z)$ give rise to stress singularities at $(b_1, 0)$. Thus, the stress intensity factor K at the tip $x = b_1$ for the original problem using Westergaard function is given by

$$(K)_{b_1} = \lim_{|\in| \to 0} \sqrt{2\pi \in}\, \Phi_R(z), \qquad 9$$

Substituting the value of) z (R Ö from equation (8) in equation (9) one gets

$$(K)_{b_1} = \sigma_{\infty}\sqrt{\pi b_1} - \frac{2}{3}\sigma_{ye}\sqrt{\frac{b_1\left(b_1^2 - a_1^2\right)}{\pi}}\left(2b_1^2 + a_1^2\right). \qquad 10$$

Since, stress remain finite at every point of the problem, $(K)_{b1}$ is equal to zero. Thus one gets

The plastic zone length $|b_1 - a_1|$ is then determined using above equation.

REMOTE STRESS

Remote stress is given by equation (11) i.e.

$$\sigma_\infty = \frac{2}{\pi}\sigma_{yc}\frac{\sqrt{b_1{}^2 - a_1{}^2}}{3}\left(2b_1{}^2 + a_1{}^2\right)$$

STRESS FUNCTION

From equation (2) non-singular part of $\Phi_R(z)$ gives the net stress function $\Psi_R(z)$ which in turn is obtained from equation (8). Hence

$$\Psi_R(z) = \frac{2}{\pi}\sigma_{yc}\left[z^3\cot^{-1}\frac{\sqrt{z^2 - b_1{}^2}}{\sqrt{b_1{}^2 - a_1{}^2}} - z\sqrt{\left(z^2 - b_1{}^2\right)\left(b_1{}^2 - a_1{}^2\right)}\right]$$

CRACK OPENING DISPLACEMENT

As given in equation (3), to obtain the value of η we need to integrate equation (13) with respect to z and take out its imaginary part. Thus η is given by

$$\eta = \frac{4}{\pi E}\sigma_{yc}\left[\left(\frac{b_1{}^4}{4} - \frac{z^4}{4} + \frac{(b_1 2 - a_1 2)}{4} - \frac{b_1{}^2\left(b_1{}^2 - a_1{}^2\right)}{2}\right)\right.$$

$$\left.\cot^{-1}\sqrt{\frac{b_1{}^2 - z^2}{b_1{}^2 - a_1{}^2}} + \sqrt{\left(b_1{}^2 - z^2\right)\left(b_1{}^2 - a_1{}^2\right)}\left(\frac{2b_1{}^2 + a_1{}^2 - z^2}{4}\right)\right]$$

Thus, crack opening displacement) (c ä given by equation (4) is

$$\delta_c = \frac{4\sigma_{yc}}{\pi E}b_1{}^2\left(b_1{}^2 - a_1{}^2\right) \qquad 15$$

CASE STUDY

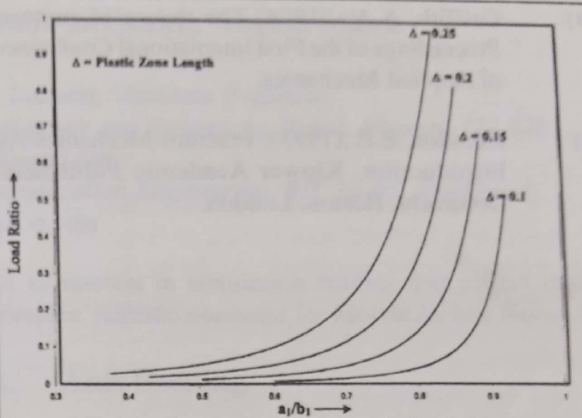

Figure 2. Variation of required load ratio to the ratio of the lengths of crack tip and plastic zone tip from origin.

Figure 2 depicts the behavior of load ratio (load applied at infinity to yield point stress) required to close the plastic zones developed versus the ratio of length of plastic zone

Figure 2. Variation of required load ratio to the ratio of the lengths of crack tip and plastic zone tip from origin.

tip and crack tip from origin. It may be noted that as a1/b1 increases load ratio also increases.

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ANT ROUTING ALGORITHMS FOR MOBILE AD HOC NETWORK

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Abstract

Mobile Ad Hoc Networks are built up of a collection of mobile devices which have no fixed Infrastructure. The task of routing is complex due to the dynamic topology, limited process and storing capability, bandwidth constraints and lack of the central control.

Ant routing resembles basic mechanisms from distributed swarm intelligence in biological systems, and turns out to become an appealing solution when routing becomes a crucial problem in a complex network scenario, where traditional routing techniques either fail completely or at least face intractable complexity. In this paper we analyze the algorithms based on Swarm Intelligence and compare these ant routing algorithms with traditional MANET routing to find the improved algorithm for enhancing the efficiency of communications in Mobile Ad hoc Networks.

***Key Words**: Swarm Intelligence (SI), Mobile Ad hoc Network (MANET), MANSI, MANHSI.*

1. Introduction

The study of *mobile ad hoc networks (MANETs)* has attracted a lot of interest, mainly from the networking community, but also from the swarm intelligence (SI) community. A significant part of the research has focused on routing, which is particularly challenging in MANETs due to their dynamic nature, and requires algorithms that work in a fully distributed way, are able to self-organize, and show robust and adaptive behavior. As a result, a number of MANET routing protocols have been proposed. However, due to the costs and technological difficulty of setting up real and large MANET test beds, most of this research is carried out in simulation. These simulations are usually based on simplified scenarios, where nodes move randomly in an open area, and rely on idealized models of physical phenomena such as radio propagation and interference. There is therefore now a lot of interest in simulation studies that reflect more complex, realistic situations for Mobile Ad hoc Network.

2. Ants Routing

Ants form a collective behavior; it is studied and applied to solve the complex engineering problems. Ant colonies are distributed biological systems that, in spite of the simplicity of their components, show highly structured social organization. Thus, ant colonies can accomplish astonishingly complex tasks that could never be performed by a single insect. The basic principle of an ant routing algorithm is that ants deposit on the ground a chemicals called pheromone, while they roam looking for food. Ants can also smell the pheromone and tend to follow with higher probability those paths characterized by strong pheromone concentrations. Pheromone decay is directly proportional to time. The pheromone trails allow the ants to find their way to the food source. The same pheromone trails can be used by other ants to find the location of the food sources discovered by their nest mates. It was found that the pheromone-trail-following behavior gives raise to the emergence of the shortest path.

2.1 Ants Self Organizing Ability (ASOA)

The ability of social insects to self organize relies on four principles: positive feedback, negative feedback, randomness, and multiple interactions. A fifth principle, stigmergy, arises as a product of the previous four [1]. Such self organization is known generally as Swarm Intelligence.

A simple example of food foraging behavior of ants provides a strong analogy to the mechanisms of ant and SI routing in general. Consider a surface upon which ants and food are distributed. The ants would like to search food source and carry it to nest i.e. food should be collected into the nest. Ant act independently of all other ants, and move only on the basis of an observed local pheromone gradient. Pheromone is a chemical excreted by the insect which evaporates and disperses over time.

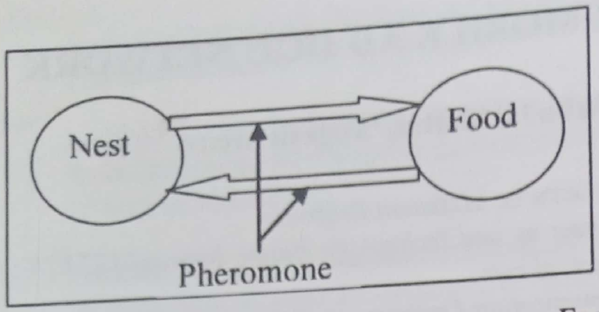

Fig. 1 Ant Pheromone laying from Nest to Food

Ant is bound by these rules:

- Ant moves randomly, but is biased towards the locally observed pheromone gradient. If no pheromone exists, an ant moves uniformly randomly in any direction.
- Each ant may carry only one part of food at a time.
- If an ant is not carrying food and it encounters food, the ant will pick it up.
- If an ant is carrying food and it encounters one, the ant will put the food down. The food will be infused with a certain amount of pheromone.

The following paragraphs explain how the principles of ants in broad sense swarm intelligence interplay in the food foraging example.

Positive Feedback: Positive feedback often represents general guidelines for a particular behavior. In this example, an ant's attraction towards the pheromone gradient biases it to adding to large collection. This is positive feedback. The larger the collection of food, the more pheromone it is likely to have, and thus an ant is more biased to move towards it and potentially add to the collection of food. The greater the bias to the food, more ants are also likely to arrive faster, further increasing the pheromone content.

Negative Feedback: In order for the pheromone to diffuse over the environment, it evaporates. This evaporation consequently weakens the pheromone, lessening the resulting gradient. A diminished gradient will attract fewer ants as they will be less likely to move in its direction. While this may seem detrimental to the task of collecting food, it is in fact essential. As the task begins, several small food collections will emerge very quickly. Those small food collections that are able to attract more ants will grow faster. As pheromone decays on lesser small food collections, ants will be less likely to visit them again, thus preventing them from growing. Negative feedback, in the form of pheromone decay, helps large collection of food grow by preventing small collection of food from continuing to attract ants. In general, negative feedback is used to remove old or poor solutions from the collective memory of the system. It is important that the decay rate of pheromone be well tuned to the problem at hand. If pheromone decays too quickly then good solutions will lose their appeal before they can be exploited. If the pheromone decays too slowly, then bad solutions will remain in the system as viable options.

Randomness: The primary driving factor in this example is randomness. Where collections start and how they end is entirely determined by chance. Small fluctuations in the behavior of ants may have a large influence in future events. Randomness is exploited to allow for new solutions to arise or to direct current solutions as they evolve to fit the environment.

Multiple Interactions: It is essential that many individuals work together at this task. If not enough ants exist, then the pheromone would decay before any more food could be added to large collection. Ants would continue their random walk, without forming any significant food.

Stigmergy: It refers to indirect communications between individuals, generally through their environment. Ants are directed to the largest food source by the pheromone gradient. There is no need for ants to directly communicate with each other or even to know of each other's existence. For this reason, ants are allowed to act independently of other individual, which greatly simplifies the necessary rules.

3. Ant Based Algorithms for MANET

Ant routing algorithms can be classified in different ways, according to how the pheromone is updated, how routing table probabilities are calculated, how often and how many ants are sent per request, and so on.

Ant Routing has been applied to many combinatorial optimization problems like the Traveling Salesman Problem (TSP) and the Quadratic Assignment Problem (QAP). In communications networks, a number of routing and load balancing mechanisms based on swarm intelligence have been proposed as shown in table 1. In Ant-based Control (**ABC**) routing algorithm Swarm Intelligence is applied to achieve load balancing in telecommunications networks. Simulated on a model of the British Telecom (BT) telephone network, ABC has been shown to result in fewer call failures than other methods such as shortest-path routing. In [2] [3], a distributed adaptive routing for datagram networks, called AntNet, has been described. Several variations of **AntNet** have been developed but all of them rely on the same concept where forward ants are launched towards destinations and backward ants travel back and update pheromone along the backward paths. The amount of added pheromone is proportional to the goodness of the path measured by the forward ant. The same concept has been extended and applied to Adaptive Swarm-based Distributed Routing (Adaptive-SDR) [4] [5] for routing in wireless and satellite networks, which incorporates a mechanism to cluster nodes into colonies so as to resolve the scalability issue in large networks.

The **MANSI:** The protocol provides multicast support for ad hoc networks. Within a multicast group, each member launches a forward ant in order to find an existing forwarding node where it can use to establish connectivity to the group with lower cost. Once such a node is found, the forward ant turns into a backward ant and returns to its origin via the reverse path, while depositing pheromone along the way to attract more future forward ants.

The **MANHSI:** Analogy to Swarm Intelligence, MANHSI utilizes small control packets equivalent to ants in the physical world. These packets, traveling like biological ants, deposit control information at nodes they visit similar to the way ants laying pheromone trails. This information, in turn, affects the behavior of other ant packets. With this form of indirect communication, the deployment of ant-like packets resembles an adaptive distributed control system that evolves itself to a more efficient state, accommodating the current condition of the Environment.

The most representative ant routing algorithms to be found in the literature with the year of evolution can be listed and categorized as follows:

Algorithms	Year
Ant Based Control (ABC) [6]	1996
AntNet [7]	1997
Cooperative Asymmetric Forwarding (CAF) [8]	1998
Routing by Ants (RBA) [9]	1998
Ant System plus Genetic Algorithm (ASGA) [10]	1998
Virtual-Wavelength Path Routing (VWPR) [11]	1999
Probabilistic Emergent Routing Algorithm (PERA) [12]	2002
Mobile Ants-Based Routing (MABR) [13]	2002
Multiple Ant Colony Optimization (MACO) [14]	2002
Ant-like Routing Algorithm (ARA) [15][16]	2002
Ant Routing Algorithm for Mobile Ad hoc Networks ARAMA [17]	2003
Ad-hoc Networking with Swarm Intelligence (ANSI) [18]	2004
Multicast for Ad hoc Network with Swarm Inteiligence (MANSI) [19]	2005
Multicast for Ad hoe Network with hybrid Swarm Intelligence (MANHSI) [20]	2007

Table 1: Ant Based Algorithms

5. MANET and Related Work

MANET has mobiles nodes. The nodes may be located in or on airplanes, ships, trucks, cars, perhaps even on people or very small devices, and there may be multiple hosts per router. A MANET is an autonomous system of mobile nodes. MANET nodes are equipped with wireless transmitters and receivers using antennas which may be omni directional (broadcast), highly-directional (point-to-point), possibly steer able, or some combination thereof. At a given point in time, depending on the nodes' positions and their transmitter and receiver coverage patterns, transmission power levels and co-channel interference levels, a wireless connectivity in the form of a random, multi hop graph or "ad hoc" network exists between the nodes. This ad hoc topology may change with time as the nodes move or adjust their transmission and reception parameters.

A number of algorithms have been proposed since the inception of idea of applying ant based algorithms for routing to MANET. Also, there exists a lot of work comparing different MANET algorithms [21], [22], but almost all of it was carried out in open space scenarios with random mobility and idealized signal propagation models. Only recently has there been an increasing interest in using more realistic setups. In [23], the authors propose a scenario with randomly placed building blocks and a simple heuristic propagation model in which only LoS communication is allowed, and evaluate how this influences the performance of AODV compared to open space. Similarly, in [24] the behavior of the DSR routing protocol is investigated in a grid shaped town scenario with only LoS radio propagation. In [25], a similar grid town pattern is used with a different heuristic radio propagation model to investigate the feasibility of a commercial MANET application.

The use of town maps and realistic ray propagation has been proposed in a few recent publications. In [26], the performance of AODV is evaluated for different traffic types in a London area, pointing out the need for high node density. The authors of [27] make a detailed simulation of the Munich city center, and evaluate how the performance of AODV in this scenario compares to that in open space simulations.

7. Conclusion

In this paper we analyze the algorithms based on Ant Routing and compare these ant routing algorithms with traditional MANET routing to find the improved algorithm for enhancing the efficiency of communications in Mobile Ad hoc Networks. Also, we propose ant routing as a powerful means to solve routing problems in Mobile Ad hoc Network (MANET). More specifically we discuss the organizing ability of ants which ants follow to enhance their collective efficiency. Authors are still working on the ant based algorithms to find solutions to routing problems in Mobile Ad hoc Network (MANET) using Network Simulator (NS-2) software.

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"Role of ERP in Supply Chain Management System"

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Abstract

E-commerce does not just mean trading and shopping on the Internet. It also means business efficiency at all operation levels. Supply Chain Management (SCM) means coordinating, scheduling and controlling procurement, production, inventories and deliveries of products and services to customers. Supply Chain Efficiency means having the right product at the right place at the right time, which can save money/reduce costs, and can enhance resource utilization. The modern ERP systems are fully integrated with e-commerce supply chain solutions like e-procurement, manufacturing, distribution, shipping, supplier and buyer-oriented marketplaces and exchanges etc. A significant number of companies in the India have implemented their latest ERP platform for Supply Chain Efficiency in the past 3 to 4 years, and large of them will follow in the next few years. The topic presents the framework of overcoming these issues and increasing value in supply chain system development and ERP systems and how the ERP system with SCM can bring the benefits to Indian organizations.

Introduction:

Traditionally, the Supply Chain Management meant assembly lines, warehouses, truckers and time sheets. In a few years, the very fundamentals of manufacturing in almost every industry have changed. Changes have taken place in the relationships between producers of primary products, manufacturers and retailers. A supply chain is a network of facilities and distribution options for the entire network of companies to work together to design, produce, deliver, and service products. Supply Chain Management means coordinating, scheduling and controlling procurement, production, inventories and deliveries of products and services to customers. Supply chain management - delivering the right product to the right place, at the right time and at the right price - is one of the most powerful engines of business transformation. Supply Chain Management includes all the steps you do everyday in your administration, operations, logistics, and information processing from your customers to suppliers.

Companies are looking at how to provide greater flexibility in moving parts globally. In an expedition for greater efficiency and lower costs, there's been growing importance given to managing the supply chain effectively for the benefit of all the parties. Effective integration of an Organizations supply chain can save millions, improve customer service and reduce inventories.

Since the last 10 years, the field of supply chain management has become extremely significant to companies in an increasingly competitive global marketplace. Companies focused primarily on manufacturing cost before 70's, quality improvements in 70's, product delivery in time in 80's, appropriate services in earlier 90's, and environmental compatibility in late 90's within their bounded walls; now their efforts extend beyond those walls to comprise the entire supply chain efficiently and intelligently in a knowledge-based economy of this Millennium (Joseph M, Kelly T; Noel P, John D; and Paul L).

India's GNP is now the fifth largest in the world. The transition to an open economy has thrust India squarely into the information age, an age that is forcing the country to cope with a flood of new information relationships. In industrialization process, IT-tools or automation have played a significant role in production quality and efficiency. Modern transportation tools have advanced delivery efficiency in a tremendous way. How does Internet and automation tools help to transform and shape today's a company in this information era? The answer is "E-business". E-business infrastructure is an information tool for optimizing the entire business management and operation processes. Recent development in technologies enables the organization to avail information easily in their organizations. These technologies are helpful to coordinates the activities to manage the supply chain. The cost of information is decreased due to the increasing rate of technologies. Modern day Supply Chain Management is the e-commerce of manufacturing. The Internet supply chain will be a means of communicating and doing business with suppliers and customers. An integrated supply chain management system is the backbone to achieve the E-business objectives (integration, automation, high-quality and reliability).

Modern supply chains focus on customers. It's important to keep in mind that the customer is just a mouse click away from your competitors. Therefore business and manufacturing processes need to be agile and scalable. When a customer wants a change they must be prepared to shift directions accordingly. It is one of the leading cost saving and revenue enhancement strategies in use today.

The latest ERP software is fully integrated with e-commerce supply chain management systems like e-procurement, manufacturing, logistics, inventories, distribution, supplier and deliveries of products and services to customers. However, these integrated ERP systems still have considerable implementation and utilization issues including complexity, infrastructures, high cost, long time to recover investments, and being too expensive for small as well as middle-size companies.

The roots of Enterprise Resource Planning (ERP) systems go back to Material Requirement Planning (MRP) systems, which were developed in the 1960s and 1970s, making it possible for the first time to plan manufacturing based on future demand rather than on historical data (Kennerly, 2001). In contrast to MRP, whose functionality was limited to procurement, production and manufacturing, ERP is cross functional, multifunctional and multidimensional, delivering real time data from only one centralized database. It is integrates and linking all departments throughout the entire organization. The different vendors, referred to as best of breed implementations, like those from the so called "big five" SAP, Oracle, PeopleSoft, JDE, Baan, which control approximately 70 percent of the ERP market – can be used jointly together (Light et al., 2001; Mabert et al., 2001).

Bingi et al., 1999 define, ERP system as a packaged business solution that is designed to automate and integrate business processes, share common data and practices across the enterprise and provide access to information in a real time environment. O'Leary defined ERP system as "computer-based systems designed to process an organization's transactions and facilitate integrated and real-time planning, production, and customer response" (O'Leary, 2000, p.27). Rosemann (1999) described the ERP system as packaged but customizable software application, which manage data from various organizational activities and provide a fully integrated solution to major organizational data management problems. It provides for both the core administrative functions, such as human resource management and accounting, as well as integrated modules which can be selected to support key business processes, such as warehousing, production and client management.

There are many different systems in a large organization's, including planning, procurement, manufacturing, distribution, shipping, and accounting. Enterprise resource planning (ERP) is a system that integrates all of these different functions into a single system, and designed to serve the needs of each different department within the organization. ERP is more of a methodology than a part of software, even though it does integrate several software applications, brought together under a single, integrated interface.

There are several positive and negative factors as far as the ERP in supply chain management scenario in India is concerned. However, having ERP in companies of India, mostly provides a profitable source of income and quality customer service, there are many challenges to the introduction of ERP in supply chain management in India. This includes replacing outdated software, change management, business process reengineering, organizational intervention, shifting from function view to process view, hiring ERP-literate and skilled staff and faith in package software in the place of custom-built software. As Gartner estimates, India's ERP market has been one of the fastest growths in Asia-Pacific. As per the best scenario forecast, India software revenues in 2008 are estimated to reach $ 211.9 million representing a double digit year-on-year growth for 2008.

Integration of ERP and E-commerce:

The idea of combining B2B e-commerce applications and ERP systems is tremendously deep-rooted into the requirements of fully integrating and automating the electronic enterprises' flows, making them more fast, effective, and efficient. For example, a B2B storefront, where the company sells its products online, represents a "front-office" of the company. However, the requirements of timely execution of the sales orders need their quick processing into the master scheduling, material requirements planning, distribution planning, and, quick passage of information to the organization's vendors. This needs an integration of the "front-office" and the ERP "back-office of the company." On the other side, the present e-commerce solutions for purchasing and outsourcing provide online vendors catalogs, immediate response, and better supplier-customer relationships. However, the e-procurement decisions are related to the overall purchasing systems in the company, supplier selection and scheduling processes, which are components of ERP. The integration of e-commerce and ERP takes place in different areas of supply chain management including its networking, planning, organizing, coordination, controlling and execution. The modern ERP systems could offer the following e-commerce supply chain management solutions:

- Integrates Web-based buying processes, including procurement, automated replenishment and multiple supplier support.
- Enables buyers and sellers to work together on demand and order forecasting, and on the dynamic exchange of information.
- Widen the efficiencies and benefits of networked supply chain management to every member of the organization.
- E-marketplace infrastructure that enables to extend the supply chain system across enterprise boundaries by linking suppliers, partners, and customers.
- Line up supply chain infrastructures to changing market conditions, such as new product launches and new customer segments that enable to reduce time to value.
- Examines every stage in the supply chain system, from price quotation to the moment the product arrives at the customer's site - including alerts when things go wrong.
- Monitors on key indicators and objectives of supply chain performance, including costs and assets across the supply chain system.
- Manages supply chains throughout all stages of the operational process - even across enterprise boundaries.

The explained solutions that integrate ERP and e-commerce supply chain management system are designed to give the benefits to all essentials of supply chain. For the customers, this integration (ERP and e-commerce supply chain) benefits might be the following:

- Access complete and correct order status information.
- Allow permanent access to the enterprise selling capabilities.
- Lesser cost for the online purchases.
- Provide fast delivery times, resulting in more customer satisfaction.
- Transform from a supply-centric to a customer-centric demand chain.

For the enterprise, the main relationship in a supply chain, the e-commerce integration with ERP systems could offer the following benefits:

- Reduce inventories and optimum utilization of recourses.
- Increase planning and organizing accuracy and real-time location of products around the world.
- Achieve more rapidly responsiveness to unanticipated demands and also improving customer satisfaction and service.
- Rapidly and easily evaluate suppliers on an overall basis.
- Match supply and demand through integrated and collective planning tools.
- Quick respond to changing customer requirements quickly and efficiently.

For the vendors, the value proposition in the integrated ERP and e-commerce supply chain might mean:

- Fast response to unexpected market demands.
- Improved capabilities for planning, organizing, coordinating and scheduling supplier production.
- Collaboration with customers on forecasting, market requirements, new product development, and delivery schedules.

Complexity in ERP and E-commerce Integration:

Having identifiable the importance and potential benefits of integrating the ERP systems with e-commerce supply chain applications, we require to recognize that the implementation of such solutions still did not actually take place in majority of the organizations. Statistics show that only 9 to 10% of organizations, that primarily utilized ERP systems, have already implemented or are implementing integrated ERP and e-commerce solutions. Most of the businesses with ERP systems still either do not have any e-commerce supply chain systems, or have a preference to utilize a non-ERP vendor organization for their e-commerce and supply chain solutions. The analysis of the ERP and e-commerce integration permitted to bunch the issues related to this implementation into these main groups:

- E-commerce related issues,
- Supply chain issues,
- Infrastructure related issues, and

- ERP-related issues.

Web-enabled ERP systems and their implementation still remain very complex, time, resources and cost consuming. These systems require plenty testing, parallel implementation, and trained experts. The cost of advancement of an existing ERP system to a web enabled depends of the organizational size. Therefore, in many cases the organizations look for cheaper e-commerce solutions for their B2B seller or buyer-oriented marketplaces, and then apply other system integration software to bridge the e-commerce applications with the presently or existing back-office systems. This situation, being typically less costly, does not provide really one-system integration of supply chain management solutions and leads to the persistence of the old practice of managing customers, manufacturing, processes and suppliers separately. In addition, the existing ERP systems are still too expensive by for the great majority of small and some mid-size organizations.

Enhancing Implementation of Integrated Solutions:

The study of the implementation of web-enabled ERP systems and their integration with B2B e-commerce solutions allowed recommending a number of directions that would definitely affect the future development and proliferation of that integration. The main idea of the projected enhancement is the simplification of the integrated solutions, minimizing their cost and future increase of hosting applications. The main highlights of these developments are as following:

- Development and implementation of simplified and enhanced web-enabled ERP and e-commerce integrated systems for small and middle-size organizations.
- Improving existing ERP and e-commerce solutions with more variety and flexibility for accommodating different customer requirements

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Designing the framework for Research Tools for the Analysis of Web Crawl Data

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Abstract

In this paper we design the frame work for a Research tools that help to enabling remote access and analysis of web crawl data. The tools are being design to gain new Insights into Indian commerce and society using data from large-scale crawls of the Indian public web.

Introduction

This paper describes the frame work for the design of a set of Research tools to facilitate new research into web crawl data. In the focus of our paper is on how large-scale web crawl data can be used to advance social science research into online networks; however we note that thecrawl data presented here are of research interest in other domains (the crawl has been collected as part of research into information retrieval).In this paper, we hope to demonstrate how Research technologies can be used to provide relationship between researchers from different area. In our example, we have crawl data that is being create as part of information retrieval research at the Common wealth Scientific and Industrial Research Organisation which a social scientist Desires to use for research. The solution that is explored is the hosting of the data in a high performance computing environment provided by the Indian Partnership for Advanced Computing National Facility, making the data accessible for research via web services Developed as part of the the Virtual Observatory for the Study of Online Networks (VOSON) Research tool. In Section 1of this paper, there are some general comments about social science web research using large-scale crawls. In Section 2of this paper, we provide an overview of The VOSON Research tool and present an outline of the computing setup that has been established in order to facilitate analysis of large-scale crawls via VOSON. In Section 3of this paper, amore complete explanation of the methods and tools that have been designed is presented via a summary of the steps involved in creating a web network data set using a 1.4% random Sample of the large-scale crawl. Preliminary analysis of the web network data is also presented. Finally, there are some brief interpretation on the role of peer-produced tools and data in the advancement of social science research into online networks.

Impact of web crawls on Social science and commerce research

The World Wide Web (WWW) has had a major impact on the people connect in commerce, participate in the political process and socially act together. Despite the marked influence of the web on many aspects of the lives of people living in industrialized countries such as India there has been very little empirical research using large-scale web crawl data into commerce and society. There are at least three major constraints that Researchers from the social sciences face when contemplating using web crawl Data for their research. The first challenge relates to the applicability of web data for testing existing social science Theories. While social scientists theorize on the emergence of a "network society" and Social Network Analysis (SNA) provides a vast array of analytical Approaches for analyzing networks arising from socially-generated processes it is not immediately clear how such research can be Operational zed with web data. To what extent can websites be seen to represent the actions of Social actors? What is the exact meaning of a hyperlink? These obviously important theoretical questions are outside the pur view of the present paper. A second challenge relates to the potentially large scale of web datasets. In computer science, the response to this challenge has been to focus on the development of automatic methods (e.g. statistical machine learning) for categorizing web pages on the basis of page content and hyperlink structure. Computer scientists also hold much hope for the Semantic Web (SW) which is an effort to build into Web pages tags or markers for data and semantic Representations of the meaning of those tags. The promise of the SW is that it will enable websites to be automatically classified, using the tags placed into the website by the site developers. While the SW holds some promise for empirical social science research, there are two major problems. First, there is the issue of how existing websites can be retrofitted for the SW. relatedly, what about archived web material, for example that contained in the Internet Archive (www.archive.org), which is now being used for social science research? Second, and more importantly, the SW assumes the existence of a single ontology (a formal representation of a set of objects and the relationships between those objects). This is not useful in the context of social science research where often the ontology governing the same set of objects will differ depending on the research question that is being asked. Also, site developers may have incentives (economic or political) to obscure what they are really about. For example, in the study of the abortion debate online, it's difficult to envisage pro-life and pro-choice groups providing website SW tags that would support a single ontology that is useful for social science research. Adaptive sampling of web data may be useful in overcoming the challenge. With adaptive sampling, a "representative" sample of websites is drawn and then coded according to the research question, and inferences are then made about the underlying population of website. This approach fits closely with the "paradigmatic approach" described by Brent and Carnahan (2007), which can be seen as an alternative to research approach involving the SW. Drawing again from Brent and Carnahan (2007), the paradigmatic approach has the following advantages (over and above the approach involving the SW): (1) it recognizes that there may be multiple incompatible views of data; (2) the data structure is imposed dynamically by the researcher as part of the research process (in contrast to the SW, where a data structure is imposed at the outset by web developers)The third challenge relates to the availability of appropriate e-Research tools to enable social scientists to work with data from large-scale web crawl data. Empirical social scientists Typically use menu-driven statistical software such as SPSS and UCINET and it is unreasonable to expect them to make use of Research tools that have been designed to suit the work practice of scientists who submit batch files for processing on remotely- located computers. We address this particular cha..enge by providing a menu-driven front-end (via The VOSON System, described below).

Virtual Observatory for the Study of Online Networks (VOSON)

The VOSON System is web-based software integrate web mining, data visualization, And more traditional empirical social science methods such as SNA. The design of VOSON is intended to Integrated but not massive with web services facilitating access and sharing of distributed sources such as datasets, methods and computational cycles.VOSON features: OS, PHP, javascript web interface (HTML is used to Improve interactivity), My SQL database, Perl-based web crawler, data Analysis in Perl/ C++, open-source statistical, text analysis and Visualization tools. The current component of VOSON is:

Text mining and Web mining

The web crawler and Google/Yahoo APIs are used to identify hyperlinks between web pages. Page meta-data and text content are extracted and parsed.??*Data preparation.* Data are collected at the page-level, but analysis is conducted over meaningful aggregations of pages ("page groups") - network nodes represent organizations, groups or people, not web pages.

Data analysis

Maps showing hyperlink shortest paths between nodes are constructed using the LGL algorithm. The LinLogLayout force-directed graphingalgorithm4 is used to visualize all nodes/links simultaneously. Where possible, statistical routines available in the R statistical software 5 are used, but because of the potentially large size of graphs involved, much computational work is done in C++, making use of the Boost Libraries. *Web services.* Web services are currently implemented using PEAR SOAP. We have developed prototype C++ web services using soap which maybe incorporated in future versions of VOSON.

Hosting VOSON services

It has high bandwidth links to international networks allowing for large, efficient data movement. This internallows research groups to host significant data collections as well as access software,

Hardware resources to mine these.VOSON's use of web services as part of its core design permits specific data and compute functionality, which were initially performed on local machines, to be moved to facilities with larger storage and more powerful compute resources. The web services programming model permits for good software engineering practices of creating flexible systems with loosely coupled interfaces. In practice this allows VOSON to leverage both local as well as

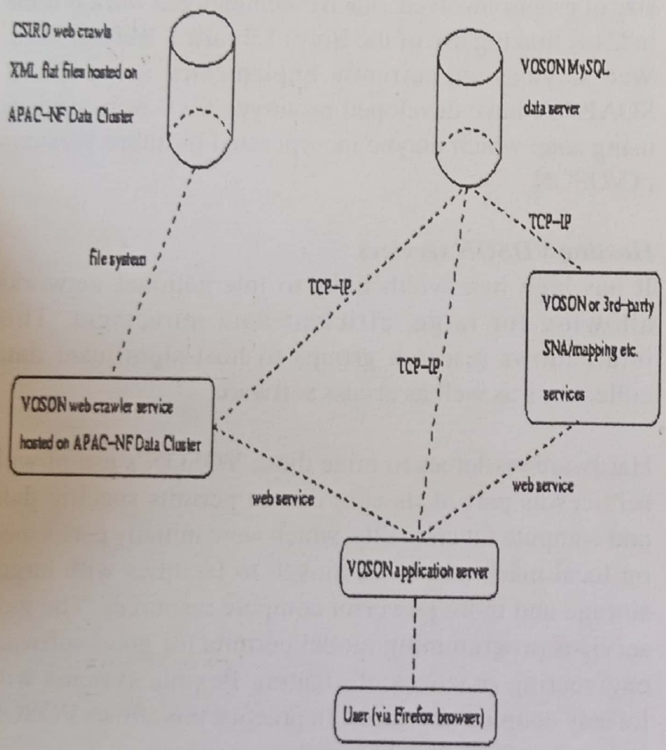
Remote compute and data resources.

1 http://pear.php.net/package/HTML_AJAX
2 http://developer.yahoo.com/yui/menu/
3 http://www.boost.org

We make use of a dedicated group of machines (the Data Cluster, DC) to securely host VOSON data processing routines which are run as web services. At this early stage of our work, the DC is used for storage of the CSIRO flatfile data and the running of the Perl web crawling routines that

Re-crawl the CSIRO data, process the retrieved hyperlink and text data, and input these data into a VOSON MySQL database. A next step will be to host VOSON MySQL

databases on the DC, and use web services to expose these data to the VOSON application server. This will enable use to take full advantage of the DC, which provides a managed, monitored point for complex database hosting. By virtue of being part of the DC, datasets automatically get backed-up for archival and reliability in case of unexpected data-loss. Further, the design of the DC allows for compute resources to sit very close to deep-storage hence allowing timely access and on-site processing of data. We intend to migrate other VOSON web services (e.g. for network mapping and sampling) onto the DC as and when the need for additional data and compute resources arises.



Analysis and Preparation of crawl data

In this section, we present a description of the steps involved with creating a web network Dataset using a 1% sample of the CSIRO crawl data, and provide preliminary analysis of this Sample. Rather than providing a thorough analysis of the data, the aim here is to give further Detail on the design and performance of the various Research tools that are making the CSIRO crawl data amenable to social science research.

Web crawl data collected by CSIRO

As part of its information retrieval research program, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is conducting large-scale crawls of the Public web (defined here as publicly- available web pages with root URLs containing the .au country-code Top-Level Domain). For the present paper, we make use of a crawl conducted in late 2005 contains around 15 million web pages from approximately 180,000 websites (website is defined here as web pages with the same root URL). Only the text information from web pages was stored in the crawl dataset (images are not collected, although the links to the images are preserved) but if a web page contains a link to a PDF or a Microsoft Office application file, a text representation of the application file was stored. An analysis of a 15percent sample of the 2005 crawl data indicated that the dataset predominantly consists of commercial websites (78 percent of sites are ".com.au")while .edu .au, .org.au and .net.au sites each account for around 5-6 percent of all sites, and.gov.au sites are approximately 3 percent. 11 For the purposes of the remainder of this paper The 180,000 websites crawled by CSIRO are referred to as "seed URLs".

Creating a VOSON network dataset using the CSIRO crawl

The aim is to eventually create a VOSON dataset containing 100% of the CSIRO crawl, which will then be used as the basis for further analysis? Further analysis of this dataset might involve the creation of data subsets (e.g. for studying a particular aspect of the public web). The dataset will also be used for extracting samples of websites using adaptive sampling procedures (where the probability of a website being sampled is related to its position in the network e.g. in degree or out degree). In this context, the demonstration is was useful for identifying potential challenges we may face in scaling up the data collection to a100% sample. *Creation of VOSON MySQL database containing seed URLs* The CSIRO crawl data are arranged such that each seed URL has its own directory which Contains the web pages extracted by the crawler; the seed URLs were obtained by parsing the Directory structure and each seed URL was inserted into the database. We also collected text Content (e.g. Meta keywords) from the main or entry page for each site crawled by CSIRO. In Order to do this, we needed to parse the XML bundles containing the pages extracted by the CSIRO crawler and then crawl the extracted pages (by hosting them sequentially on a local

Web server) and this is why this step took 0.5 hours (the Perl xml parser took several seconds To parse the larger XML bundles). After this step, the VOSON database contained 1950 Records.

Crawling of URLs

Next, each of the 1950 seed URLs was "re-crawled" by the VOSON crawler to extract hyperlinks (note: only non-intrinsic hyperlinks, or hyperlinks pointing "outside" of the site, were extracted). For this preliminary work, only the first 50 pages of each site were crawled. This step took 1.4 hours and again, much the time was taken by the Perl XML parser. After This step, the VOSON database contained 29,065 records: the 1950 seed URLs and the 26,115 Web pages that the seed URLs link to. T he root URL or hostname is the portion of the URL between the "http://" and the next "/". For example the root URL of http://www.example.com/mydir/mypage.html is www.e"xample.com".

Note that that the dataset used only contained text content (e.g. met keywords) - it did not contain hyperlink data, which is the focus of the present paper.

Processing of URLs and URLs linked to by seed URLs

Various processing was conducted in order to improve the data as a source of information on the web networking of organizations (this step took 353 seconds for the database created from the 1% sample). The database is a collection of URLs, but we ultimately want to construct web graphs where an organization represented a by a single node, rather than possibly hundreds of nodes (reflecting the 100s of pages from that organization's website that were picked up by crawler).URLs that did not conform with the Hypertext Transfer Protocol (HTTP), i.e. beginning with "http://" or "https://", were removed from the database. This reduced the number of records by 418.All URLs were reduced to their hostname or root URL - and this string is stored as theURL's "page group" identifier. In a later stage (the creation of "analysis" databases),all pages from the same page group are grouped into a single node in the web graph. Often an organization will have several hostnames (or even domain names); if this isn't taken into account, then the organization will be represented by multiple nodes in the one network graph. Organizations with more than one hostname were automatically identified and placed into the same page group. For example, in this step, http://voson.anu.edu.au and http://adsri.anu.edu.au would be placed in the same page group. Depending on the research context, the above data processing step can cause problems for analysis. but in other contexts (e.g., research into the web presence or collaboration of particular disciplinary teams) this would be highly problematic and there would be a need to represent various departments/ research schools as separate nodes. For this reason, it is possible to Identify (via a text file) subsites that should not be automatically grouped together (particular use of this feature is to prevent the grouping together of sites that are hosted by the same commercial hosting service).Via a text file, additional sites can also be pruned from the database. The question of whether to prune a given site is dependent on the research that is being conducted. AClassic example of a site that one may want to prune is http://www.adobe.com/ –many sites link to adobe to enable people to download the acrobat pdf reader and Consequently, adobe is often the most central node in the network. The structure of a Network is often changed markedly by pruning adobe from the database (e.g. sites that Are connected via their hyperlinks to adobe and look "close together" in the force directed Graphs will become further apart once adobe is pruned).Creation of "analysis" databases mentioned above, the records in the VOSON database correspond to web pages, but much Of the analysis we want to conduct involves representing organizations as single nodes in the Network. In this step an "analysis" database is created where each record is a page group or Site. The size of the database was reduced by 15 percent to 21,800 records. The creation of an analysis database is fairly data intensive (because it involves adjusting link information) andit took 100 seconds for our test database.

Preliminary analysis

An analysis of the link structure of the 1% sample revealed a surprisingly amount of connectivity - 17,388 or 80% of the 21,800 nodes form a single component. Within this component, 64% of the sites are ".com", 11% are ".org", while ".edu", ".gov" and ".net" each account for 6% of the sites. As expected, the majority (52%) of the sites are Australian, while the UK the US each account for 2% of the sites, and Canada, France, Germany and New Zealand each account for 1% of the sites, and the remainder of the sites are from other countries or "unknown". The average in degree of sites in the component was 1.3, while average out degree (calculated over the seed URLs) was 2.7. The sites were ranked according to in degree and of the top-50 sites, 14 were web technology or computer companies (e.g. adobe, Google, web site traffic monitoring companies); 14 were government sites; 7 were commercial web hosting sites (e.g. users.bigpond.com.au, www.geocities.com); 6 were media sites (e.g. newspapers); 5 were company web sites, and 4 were university web sites. The above indicates the need for the data pre-processing mentioned earlier in order to control for the presence of companies that are being linked to simply because they provide software that is used in either the development of websites or by people browsing the web (e.g. adobe) and also to ensure that sites that are being hosted on commercial hosting sites are not grouped together.

Peer-produced tools and data for research into online Networks

A major aim of the VOSON project is to provide a platform that will enable collaborative and Seamless access to the wide range of tools and data sources that is necessary for conducting Research into online networks. Web services can facilitate access to network research tools Developed by 3rd parties (that is, while the network research tools that are currently accessible within VOSON have all been developed "in-house", our goal is to attract the Participation of other developers of network research tools who are interested in hosting their own tools services, or at least contributing source code for services that can be hosted elsewhere).With regards to collaborative access to and sharing of data, the VOSON system incorporates the concept of a "data common" - this is a web network database that a group of researchers jointly access and which they are encouraged to improve. Via a wiki, researchers are able to collaboratively edit configuration files that feed into the data processing steps that were outlined above. For example, via the wiki, researchers can: identify which sites to prune from the database, select sites for merging (e.g. when an organization has several domain names); flagged sites that should not be automatically grouped with other sites (e.g. because they are hosted by a common commercial hosting service), identify new seed sites for crawling, classify sites according particular research domains, modify classification schemes. The VOSON project can therefore be seen as an example of peer-produced tools and data for the advancement of social science research into online networks. VOSON also has something in common with the emerging phenomenon of Internet-enabled collaboration which Tap Scott and Williams (2007) term "wikinomics" and "User innovation" Social science research into online networks involves the use of a number of tools (e.g. web crawler, text mining, social network analysis)and it is not feasible for a single tool developer to be able to "keep up" with the modifications to the tools that are needed to keep pace with developments in research methodology. Web services can enable network researchers to make their tools available to other researchers, thus spurring further innovation in network research.

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Total Quality Management (TQM) Applied to self financed Engineering Institutions

A quality function deployment (QFD) approach

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Abstract

This paper presents use of quality function deployment QFD which provides priority to technical requirements and also provides correlation with students/customer requirements for the present Indian context. In addition to future scope of the research also provides a house of quality (HOQ). The research identifies technical and students requirements for the modern educational set up, also provides information about the severity of various technical requirements of competitive environment of education. It also recognizes the need for continuous improvement and effective use of financial resources to improve the value addition at each stage. Conclusion of this research provides some opportunities for reflection by students, faculty members and administrative management of institution for continuous development at individually as well as institutional level. During this research work mix use of qualitative and quantitative approaches provides the evaluation of present education system but also develops an understanding of future challenges to continuous improvement.

***Keywords**- quality function deployment (QFD), house of quality (HOQ), technical training, finance companies, customer/students, matrix, technical characteristics/ requirements.*

Introduction

The principles of T.Q. M. are now a recognized characteristic of most of successful businesses world over. Customers changing demands, the awesome penetration of Japans (Asian lion) and its pacific Rim neighbors, viz, South Korea, Taiwan, Singapore and Hong Kong (called Asian tigers) in to the US and western markets and the need fore stringent cost management in fluctuating environments, make TQM a practice of paramount importance for every enterprise, big or small .Gone are the days when customers considered price as the main reason for purchasing a product or service. Quality and reliability are now the overriding factors which customers favor in exercising choice. Meeting customer's specifications, dependability of service and speed of delivery are the very distinguishing features of success. No other theory of business management addresses these issues more fully than TQM.

Western world claims that the TQM concept was originated in the west and exported to the east after the Second World War when spurned by western industrialists as impracticable.

Mr. Subodh Bhargava, Group chief Executive of Eicher revealed an interesting fact. TQM is not new to India and has its roots in Indian ancient scriptures like the Upnishads and the Srimad Bhagavadgita. The term TQM says Bhargava, "is comparable with some of the Vedic terms .Total which litrally means 100 percent is the whole space or Advatiya. Quality will put down the boundary, which "Dharma" gives the permission to achieve. And finally, the "Karma" and "Purushartha", parallel to the term Management that is what one must perform. This means TQM concept is embedded in the scriptures and culture of India.

"The West only discovers what the east already knows" declares Mr. Sunil Kumar when he talks about motivation empowerment and Total Quality Management (TQM) Mr. Kumar teach at the Shri Sringiri Shard Institute of Management (SSSIM), a management school located in a temple complex in a posh south Delhi locality .He quotes the Indian scriptures. At manav viddi" –Know your inner Strength.

Similarly,Mr.M.B.Athreya, a management consultant and a strong proponent of Indian style of management talks about "Vivek" (mind) management Model and emphasizes that the Indian way of working is very different ; all American models will fail in our context. Athreya in TQM context identifies some down-to-earth concepts from the "Vedas" that he feels can guide corporate world today. Profit is compensation for service to society and companies exist to satisfy the need of people (Yagua-arthat Karmanaha parasparan bhavayantaha).Every person has immense potential (Aham Brahamasmi).

My Customer Is Not Different From Me (Advaita). The World Is My House (Vasudhev Kutumbakam). That Cover

All TQM aspects like social- cost benefit, HRD, Customer Focus And Globalization. According to Athreya these scriptural ideas could help solve many management problems.

However, even with overwhelming evidence to the contrary, many companies have failed in their attempts to realize the benefits of TQM. This has been borne out by a number of industrial surveys which show that lack of sustained commitment by senior management of inadequate planning have often contributed to a shortfall in the business results hoped for from TQM initiatives. Other cause of failure included the inability registration, failure to identify and satisfy true customer needs or to progress beyond registration to quality system standards –ISO 9000.

The prospect of implementing a TQM drive, where much larger companies have failed, must prove daunting for small businesses where the lack of resources, if not the motivation, could easily impede the implementation of such a fundamental change.

Application of TQM in engineering education:

In keeping with the newer demands that have been placed on the engineering educational system by the various stakeholders, the technical educational system in particular, has been pressured to shift its focus from one in quantitative expansion to one with emphasis on quality. Growth and survival of these institutes is fully depending on their competitive working style, opinions of their customers / students about their performance, and contribution to economic growth. It is being increasingly recognized that high quality of products and services are associated with customer satisfaction and they are the key points for survival for any organization whether educational or otherwise. Not oblivious to the need for adaptation to serve the interests of its stakeholders, in terms of total quality management (TQM) in education. There is a growing interest in applying TQM in education for a wide variety of reasons, including.

- Pressures from industry for continuous upgrading of academic standards with changing technology.
- Government schemes with allocation of funds, which encourage research and teaching in the field of quality.
- Increasing competition between various private and government academic institutions; and
- a reduction in the pool of funds for research and teaching, implying that only reputable institutions will have a likely chance of gaining access to various funds.

However, defining students as customer of the academic system has received various comments in literature. Downey et.al. (1994) note that the primary customer in an education system is the student who is both an internal and an external customer. While in the system, the student is an internal customer, participating in the learning process; he or she becomes an external customer when they leave the system. They then become the ultimate external customer, functioning effectively in the society.

The word TQM itself suggests many associations in the mind of user. Various views on the acceptance of the approach as philosophy or process have generated numerous definitions. For example:

- **Witcher** (1990) defines the term by breaking the phrase into three terms, whereby "total" implies very person is involved (including customers and suppliers) "quality", implies customer requirements are met exactly, and "management", implies senior executives are committed.
- **Taylor and Hill** (1992) defines TQM as a customer focused process which seeks continuous improvement and meeting customer's perceptions
- **Williams** (1993 p. 374) concludes that there are two dimensions of TQM. On the one hand "it is a management tool to increase productivity, keep the customers happy, and cut down waste". On the other hand "it is a means of making us better people, of developing our professional good manners, and of providing us with a moral education".

A comprehensive view of definitions suggests that the whole philosophy of TQM mainly revolves around involvement of people at all level, understanding customer requirements and working towards that satisfaction, commitment of top management and development of a culture where organization wide impact on be realized.

Before we see the relevance and usefulness of TQM in education, let us try to examine the meaning of quality in an educational context. Literature reports various views on the interpretation and definition of the word "quality". An output focused approach defines "quality" as, "the totally of features and characteristics of a product or service that bears on its ability to satisfy given needs" (Mohanty and Behera, 1996, p. 14) "Quality" in general is defined as "the ability of a product to satisfy stated or implied requirements". Less contradiction is found in the use of the word in manufacturing, yet not a single definition is accepted with confidence for the service sector. This is because of the intangibility of services which leads to varied perceptions of customers about the expected or derived benefits. In the present case of technical education, different stakeholders hold different beliefs and hence their views on quality in education are found to be in conflict. An overview of some reported views on definitions and understanding of quality in education is presented in Table.

It seems from the various views that understanding of "quality in education" varies because of lack of clarity on stakeholders, customers and elements of process where changes are required. Thus, "quality" in education is a complex concept with varying conceptualizations and this poses problems in formulating a single, comprehensive definition.

According to Harris (1994 p. 34) there are three generic approaches to TQM – first, a customer focused approach, where the idea of service to students is fostered through staff training and development, second, a staff focused approach, that is concerned with value and enhancement of the contribution of all the members of staff to the effectiveness of the school, and the third, a service agreement focus that seeks to ensure conformity to specifications at certain key measurable points of the educational process. In reviewing the objectives of technical institutions it should be realized that a various views on application and interpretation of TQM philosophy in education. A summary of some interesting views is provided in Table 1.2.

From the understanding developed on the various elements of TQM and their relevance to technical education we develop a framework depicting objectives, required characteristics of TQM, and their outcomes as shown in Figure 1.1.

Matthews (1993) cites the following four critical barriers to the utilization of TQM in academia.

(1) The highly generic and inappropriate nature of an average institution mission.
(2) A lack of agreement within the academic environment as to the meaning or implications of "quality and excellence"
(3) The independence of key individuals within the academic environment and
(4) The reluctance of college or university leaders to play an aggressive and creative role in TQM implementation.

The research aims to develop an understanding of TQM philosophy in education through a development of QFD matrix. It tries to identify some critical barriers to TQM implementation in the Indian context. More precisely, the objectives of the research are:

- To indicate the usefulness of TQM in education.
- To identify the customer / student requirements and needed technical characteristics of a technical education system.
- To develop insights into the new perceptions needed under new conditions of competition for self-financed technical institutions.
- To develop an understanding on the relative importance of various technical requirements and their relationships with customers / students needs.
- And to explore the barriers to TQM implementation in technical education.

Table:-1.1. Views reported on quality in education from various authors:

Author	Views
Lagerweij and Voogt (1990)	Emphasize the dynamism and conclude that, while the concept of quality in education cannot be easily defined in a clear and exact manner, any definition of quality should be expected to change over time, because "it necessarily reflects a society's interpretation of educational needs and the intensity of its moral and financial commitment to fulfilling them"
Mortimore and Stone (1990)	Draw attention to the "normative and comparative" element inherent in quality, emphasizing quality in education as "an attribute or defining essence, a degree of relative worth; a description of something good or excellent and a non-quantified trait."
Govinda and Varghese (1992)	Defined in a contextual manner, taking into account the external environment in which schools are operating; the internal environment in which the teaching learning process takes place and the home environment of the learners.
Ovretveit (1992)	Views quality from a health service perspective, but this may be redefined for education and may take the following forms: client quality, i.e. what the customers and clients want from the service; professional quality i.e. whether the service meets the needs of the professional providers and the clients and management quality i.e. the efficient and productive use of resources within limits set by higher authorities.
West-Burnham (1992)	Refers to the issue of "quality in education", as a perennial one, that he feels is incapable of a solution as far as a definition is concerned.
Cheng (1996)	..... the character of the set of elements in the input, process and output of the education system that provides services that completely satisfy both internal and external strategic constituencies by meeting their explicit and implicit expectations.

Table: - 1.2. Literature review on QFD and TQM in education:

Author	Nature of work
Holmes and McElwee (1995)	Present the view that total quality management in higher education institutions, and the development of a so-called managerialist ideology, have led to the inevitable adoption of an approach to human resource management (HRM) policy and practice which is functionalist. They discuss the inappropriateness of TQM in higher education based on the argument that it limits the productivity of individual. They propose an alternative model based on HRM ideology.
Elmuti et al. (1996)	Evaluates the scope of TQM in higher education. A survey-based approach is adopted to investigate the status, usefulness and limitations of total quality management programmes from the perspective of institutions of higher education largely in the Midwestern USA.
Idrus (1996)	Presents a literature review on practices in applying quality concepts to education around the world. Claims that exposure to these will assist in choosing the most appropriate approach to implementing quality concepts in New Zealand educational institutions.
Kwan (1996)	Attempts to explain the usefulness of TQM in education and highlights the differences that exist in its application compared with industry.
Swift (1996)	This is a real life survey-based research which identifies problem areas for the selected engineering institutions and reports the benefits of group projects. It suggests the measures for improvement in quality of education with application of quality control and management.
Mohanty and Behera (1996)	Discusses applicability of TQM in service sector and evaluates associated problems along with benefits which could be achieved through successful implementation.
Motwani and Kumar (1997)	Looks at the applicability of total quality management (TQM) in education and some of the concerns addressed in the literature. Suggests a five-step programming model: deciding, preparing, starting, integrating and evaluating as different phases that any university can use for implementing TQM.
Owlia and	Initially a system dynamics approach is applied to strengthen the understanding

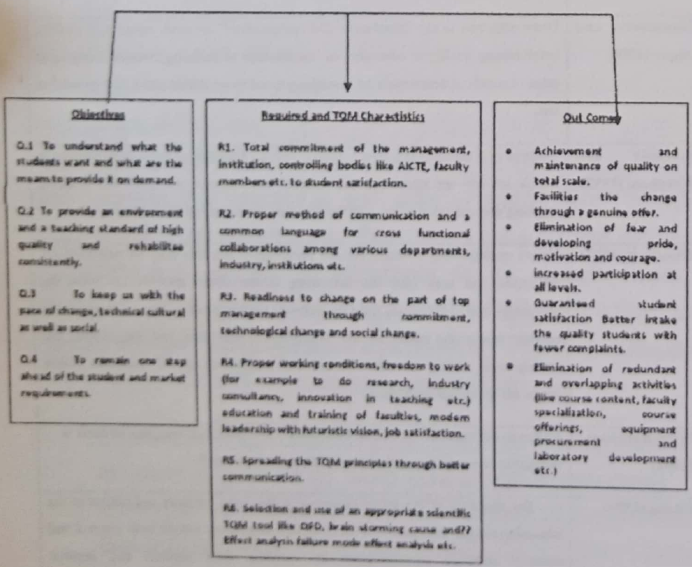


Fig.1.1. - Objectives, characteristics and outcomes of TQM for engg. Institutions

The research initially described the importance of use of quality and TQM in education. The remainder of this research is structured as follows. Sections 3 and 4 develop a QFD model which explorers various customer requirements and correlates them with technical requirements of the system. In section 4, we propose a four-phase model starting from basic phase – house of quality – to incorporate timely changes in the QFD model with the changing maturity of institution. In section 4, we provide a generic framework of force-field analysis for evaluating various barriers and facilitators to TQM implementation in education. The remaining sections discuss the results of present work and develop insights into their importance. We sum-up by exploring the opportunities for future research in this direction.

The major tool Employed is Quality Function Deployment (QFD) to listen to the voice of the customers (Students) QFD has found widespread acceptance in the industry as an effective tool to translated customer requirements in to product features. In this approach, several steps are followed to find out customer needs in to the production process and ensure that at each level the highest possible quality is achieved.

QFD is simply a planning tool. It begins with market research that identifies just what the customers like, which is called the voice of the customer (VOC). It is through the QFD process that the VOC is translated in to system and part requirements. QFD will be applied to study engineering education.

Quality function deployment: a tool for achieving quality:

QFD which is a customer-driven planning process, answers "What" and "How" questions by capturing the voice of the customer in Industry and society. Quality is broken down into tangible, manageable, technical and operational actions so as to ensure that the customer's needs and expectations are met in a timely fashion.

Quality function deployment can be defined as a system for designing a product or service based on customer demands and involving all members of the organization (Maddux et al. 1991 p. 34) QFD is a system for designing a product or a service based on customer wants, involving all members of the supplying organization. It helps to determine opportunities that can be developed effectively environment of a technical institution, it is extremely difficult to keep pace with changing curriculum requirements and students expectations and hence of knowing the opportunities that are down the track, that would help the institution in upgrading their standards in timely and effective manner.

QFD is an ideal opportunity to move away from "we know best what the customer wants" to a new culture of "let's hear the voice of the customer"(Zairi and Youssef, 1995) In a sense, it enables the organization to become very much proactive to quality problems rather than being reactive to them by waiting for customer complaints QFD does provide competitive benchmarks to the organizations to compare their product quality standards to those of their competitors thus helping them establish a competitive edge. QFD has three major objectives to identify who the customer is, what the customer wants and how to fulfill the customer's wants. Besides its power as a benchmarking tool QFD offers a wide variety of benefits including the following:

☆ It makes the customer as centre and starting point.

☆ It promotes team work and encourages cross functional inputs from various departments like marketing, production, development, design etc.

☆ It is a tool for continuous long-term improvement. It offers the ability to prioritize customers' own preferences and following a ranking procedure for technical characteristics, where suppliers (in the present context of technical institutions) may not necessarily have to focus on customer's top priorities if they can justify their own strengths in terms of customer benefits.

In this research, the idea of QFD implementation is developed for self-financed technical institutions. In the current era of globalization, customers / students of these institutions are looking for educational standards and environment, which can put them on par with the emerging market trends, market needs, technological developments and competition.

QFD is an essential pillar for achieving TQM. The TQM literature indicates that building quality into a product starts with asking "What does the customer need? QFD is a useful tool in answering this question. In addition, the "how's" of the QFD or the "voice of the company" are important for explaining how the company meets or exceeds the customer needs. In addition, by recognizing the interrelationships, appropriate actions can be taken at every stage of the product's development, so that customer needs are anticipated, prioritized and effectively incorporated into the product (Logothetis, 2004 p. 210) In the context of a technical institution, where student's requirements are continuously changing with the rapid technological advancements, timely changes in curriculum, student teacher, relationships, faculty improvement aspects, industry-institute togetherness, R & D scope etc. can be incorporated. Some useful work on the application of QFD and adoption of TQM in education is summarized in Table 4.1.

An application of QFD to a technical institution:

Here, students are perceived as customers of the modern educational system. In this step, the student's voice is expressed in distinct actionable requirements from the hard issues of infrastructure / soft issues of work culture, discipline and teaching standard. It requires the attention to both tangible and intangible parameters. The domain of tangible parameters covers the issues like number of sets of equipments in the laboratory, number of books available in library, number of students recruited etc., while intangible issues address areas of overall working culture of the institute, student teacher relationships, and teacher's interpersonal relationship etc. Now, all of these requirements are not of same level of importance from student's point of view, and hence customer importance rating of these detailed requirements is given on the scale of 1 (least important) to 10 (most important)

The imp. rating is to be prepared by a brain storming session and asking questions from students and senior faculty members. Before asking questions a questionnaire should be prepared by breaking whole the system in to small questions. Each importance activity is to be sub-divided into 10 small ask able questions. Each question is to be ranked as per applicable facility available in the institute. Points are scaled as given below:-

For very good	5 Points.
For good	4 Points.
For Normal	3 Points
For poor	2 Points
For very poor	1 Point.

After summing up these points we assign importance rank to each imp. Characteristics from the scale (1-10). The questionnaire and applicability in a particular institute is given below in a tabular form. After the table QFD matrix is prepared for each institute separately this shows the applicability of TQM in the particular institute (fig.1.2).

COLLEGE NAME: 1.

1.Management commitments, leadership and continuous improvement:

Questions	V.G	Good	Normal	Poor	V.P
1. Top management, leadership and commitment support assured for TQM implementation		•			
2. Top management considers quality important for achieving its goals	•				
3. Quality policies have been clearly started & communicated to all by top management		•			
4. Continuously monitors the system and processes in organization			•		
5. Identifies opportunities for improvements		•			
6. There is proper planning and monitoring		•			
7. Efficient and effective recruitment process		•			
8. Motivational initiatives are taken	•				
9. Decentralization and participation of faculty		•			
10. Identifies opportunities for encouragement	•				

Total score (out of 50) = 42
Importance rating (in the scale 1-10
***indicates applicable**

2. Financial resources: Allocation and utilization:

Questions	V.G	Good	Normal	Poor	V.P
1. Sufficient budget is allocated to institute.	•				
2. Budget distribution among various departments is good		•			
3. Financial non financial records are given to individuals			•		
4. Sufficient financial resources are available for imparting training or attending conferences and international conferences	•				
5. Financial funds are provided for organizing workshops, seminars	•				
6. Effective utilization of financial resources		•			
7. Sufficient budget is provided for faculty up gradation		•			
8. Sufficient funds are provided for meritorious & poor students		•			
9. Sufficient funds are provided for extracurricular & co-curricular activities		•			
10. Sufficient funds are provided for undertaking research activities			•		

Total score (out of 50) = 41
Importance rating (in the scale 1-10) = 8

3. Physical facilities:

Questions	V.G	Good	Normal	Poor	V.P
1. Good separate hostel for boys and girls.	•				
2. Provision for power backup at institute and hostel.	•				
3. Reprographic facilities are available.		•			
4. Proper banking & post office facilities.				•	
5. Shopping complex.		•			
6. Counseling and guidance are provided.		•			
7. Medical facilities are available.			•		
8. Canteen facility.	•				
9. Internet facilities are provided.	•				
10. Good transport facility.			•		

Total score (out of 50) = 40
Importance rating (in the scale 1-10) = 8

4. Teaching and learning methodology:

Questions	V.G	Good	Normal	Poor	V.P
1. There is proper academic calendar.	•				
2. There are well-defined channels of communication.		•			
3. There is continuous evaluation procedure.		•			
4. Timely feed back on performance is taken.		•			
5. There are firm rules and regulations.		•			
6. Good information access facility.	•				
7. Emphasis on training and personality development for skill up gradation.			•		
8. Students publications.			•		
9. Contents beyond the syllabus are covered.	•				
10. Students centric learning initiatives are taken.		•			

Total score (out of 50) = 41
Importance rating (in the scale 1-10) = 8

5. Research and development:

Questions	V.G	Good	Normal	Poor	V.P
1. Budget for in house R&D activities.		✓			
2. Effective utilization of budget.		✓			
3. Proper lab facilities for R&D.		✓			
4. Academic/sponsored/industrial research and development.			✓		
5. Research publications.		✓			
6. Patents.				✓	
7. Industry participation in development and students related activities.		✓			
8. Emphasis on continuing education.		✓			
9. Consultancy and testing.				✓	
10. Students project work.		✓			

Total score (out of 50) = 35

Importance rating (in the scale 1-10) = 7

6. Human resources: Faculty and staff

Questions	V.G	Good	Normal	Poor	V.P
1. Expert and experienced faculty.	✓				
2. Total employee involvement.		✓			
3. There is trust among all members of faculty and staff.		✓			
4. Clearly defined service rules.	✓				
5. Autonomy of work freedom.		✓			
6. Opportunity and control for curriculum development and preparation.			✓		
7. In service training and development.		✓			
8. There is good reward policy and incentive scheme.		✓			
9. Teamwork is emphasized.		✓			
10. Due respect is given to all.		✓			

Total score (out of 50) = 41

Importance rating (in the scale 1-10) = 8

7. Human resources: students

Questions	V G	Good	Normal	Poor	V P
1. There is transparency and meritocracy in student's admissions	✓				
2. Academic results are up to expected level.		✓			
3. Good performance of students in competitive examinations		✓			
4. Seniors are supportive.		✓			
5. Relevance of curriculum to future needs.			✓		
6. Clarity in course objectives.		✓			
7. Provision for appropriate class hours.		✓			
8. Individualized/personalized attention given to students.		✓			
9. Good opportunities for campus placements are available.		✓			
10. Alumni interaction.	✓				

Total score (out of 50) = 41

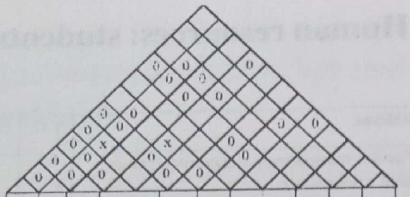
Importance rating (in the scale 1-10) = 8

8. Supplementary processes :

Questions	V.G	Good	Normal	Poor	V.P
1. Extracurricular & co-curricular activities.		✓			
2. Transparent flow of information to all.		✓			
3. Professional society's activities.			✓		
4. Building sense of social responsibilities.			✓		
5. Entrepreneurship development.			✓		
6. Redress & grievances of students without delay.			✓		
7. Autonomy of work.		✓			
8. Sports and recreation.		✓			
9. Participation of industry in designing the course curricula.				✓	
10. Ethics.		✓			

Total score (out of 50) = 34

Importance rating (in the scale 1-10) = 6



Design Requirements / Importance / customer requirements			Clear and specific policies and procedures	Clear organization structure	Delegation of authority	Discipline	Budget priorities	Emphasis on continuous improvement	Cross-functional collaboration	Suitability and relevance of curriculum	Participation and involvement	Trustworthiness among all	Employment opportunities for students	Student's evaluation as an employee by the industry
Improvement quality in Institute	Management commitment and continuous improvement	9	1	9	9	1	9	9	9	3	3	3	3	1
	Financial resources: Allocation and utilization	8	9	3	3	1	9	9	1	3	3	1	1	1
	Physical facilities	8	3	1	9	3	9	3	1	1	3	1	1	3
	Teaching and learning methodology:	8	3	9	9	9	3	9	3	1	9	1	9	9
	R.&D.	7	1	3	3	3	9	9	3	1	1	1	9	9
	H.R. Faculty and staff	8	3	9	3	3	9	3	1	1	3	1	3	9
	H.R. students	8	3	3	1	9	3	3	3	9	9	1	9	9
	Supplementary processes	6	3	3	1	3	3	1	1	9	1	1	1	3
	Column weight		202	320	308	248	426	366	180	208	246	080	280	338
	Imp. Ranking		10	04	05	07	01	02	11	09	08	12	06	03

Fig.1.2 QFD Chart of Engineering Institute No. 01

Views on TQM and its applications in Engg. Education.

Author	Views
Harris (1994)	Specifies three generic approaches to TQM – first a customer focus approach, where the idea of service to students is fostered through staff training and development; second, a staff focus approach, that is concerned with value and enhancement of the contribution of all the members of staff to the effectiveness of the school; and third, that takes a service agreement focus and seeks to ensure conformity with specification at certain key measurable points of the educational process.
Burkhalter (1994,p. 170)	TQM is a strategically integrated approach that involves that three stakeholders including employees, customers and funding bodies.
Dahlgaard et. al. (1995)	An educational culture characterized by increased customer, satisfaction through continuous improvement in which all employees and students actively participate.
Mukherjee (1995 p. 573)	Total quality encompasses all three aspects of quality i.e. value-to-price, value-to-cost, and error-free-performance which are of concern to the customers, producer and society respectively.
Anjard (1995 p. 15)	Total quality management is an integrated system that consists of : • a competitive strategy. • a technology to produce goods and services. • a way of managing the organization.
Mohanty and Behera (1996, p. 13)	To implement TQM effectively in service organizations requires an understanding of the : • Unique characteristics of service operations. • Roles of service providers and service clients. • Application of appropriate quality control concepts, tools and

Karapetrovic and Willborn (1997, p. 289) support use of QFD in education from student's perspective. They believes that quality function deployment (QFD) is a technique that can be applied for translating customer needs and requirements into a set of course / programmes specifications, as well as proper needs and requirements for student knowledge, including appropriate examination techniques. In this section, we present an application of QFD to contemporary technical institutions. Here, we only present the main results, as analysis of house of quality (HOQ) is straightforward and can be found in many other results, as analysis of house of quality (HOQ) is straightforward and can be found in many other sources. We will focus, however, on the use of QFD and the construction of HOQ to analyses and improve the quality of technical institutions.

The what's

In QFD analysis, the process starts with the construction of the house of quality, which requires the identification of the customers' requirements. These describe the product characteristics or represent the areas of concern. It is however, easy to use questionnaires to obtain the voice of the customers, and rank the different aspects of customer needs, especially in this case, and in cases when information is not personal or confidential. We must, of course, make sure that all customer needs are taken into consideration and the information collected is reliable. In the present study, for the sake of convenience, focused questionnaire survey and interviews of a sample of three self-financed technical institutions were conducted to identify the customer / students requirements. It is observed that these requirements are pertinent to different areas like infrastructure, culture, library and research standards etc. The detailed classification of all of these requirements and their ratings are given on Table 1.2a. In the present case subjective judgments of senior faculty members and students are utilized for rating the various criteria. But as these ratings have an overall impact on the whole analysis of QFD, it is recommended that institution should be very careful in involving, besides students and faculty members, the funding bodies, controlling body like All India Council for Technical Education (AICTE), other institutions in the same field etc. to identify the long-term considerations like quality development and financial requirements, policies of government, interests and intentions of self financed institutions, student's interest and institutions progress, overall competitiveness of educational industry vis-à-vis progress and development of an individual institution.

The how's

After establishing what's (Table 1.2a), the corresponding "how's" are derived next. The 'how's" are called technical requirements. These technical requirements represent how an institution will respond to customer wants and needs. The first step is to translate the customer voices into technical requirements. The voices must be translated into the type of language that can be used to describe the expected characteristics of technical institutions. At the same time, the technical requirements must not represent solutions. The objective is to translate each voice into one or more technical requirement. After some brainstorming sessions together with management and senior faculty members, the list of technical requirements is finalized as indicated in Table 1.3.

Table 1.2(a)

Customer/Students requirements identification

Broad Classification	Codes	Detailed requirements	Importance Rating
Infrastructural requirements (A)	A1	College building and premises	7
	A2	Availability of sufficient space for various laboratories and classrooms	8
	A3	Seminar halls	4
	A4	Auditorium	4
	A5	Hostel and messing facility	6
	A6	Quality and standard of the equipment available in laboratories	8
	A7	Sports complex	4
	A8	Transportation facility	4
	A9	Research facility	8
Teaching standard (B)	B1	Qualifications of teaching staff	10
	B2	Teaching experience of staff	9
	B3	Industry experience of staff	7
	B4	Research work and publications by the faculty members	6
	B5	Method and quality of teaching	7
Overall working culture of institute (C)	C1	Respect for each one another	6
	C2	Attitude of teachers to students	6
	C3	Attitude of students to teachers	7
	C4	Number of activities arranged by faculty members for the overall development of students.	8
	C5	Number of initiatives taken by the students in extracurricular activities along with studies.	6
	C6	Support of administrative staff to students and faculty members	5
	C7	Directions and promptness from the head of the institution.	9
Opportunities provided by institute (D)	D1	Student participation in intercollegiate and state or national level competitions	6
	D2	Number of students recruited by the campus interview	10
Industry-institute interaction (E)	E1	Number of industry visits arranged by the institution.	7
	E2	Number of industry projects undertaken by institute	6
Student's involvement in institute activity (F)	F1	Selection of student representatives and their importance and involvement in some joint ventures	4
Institute-institute interaction (G)	G1	Number of combined projects handled with other institutions	5
	G2	Involvement of experts of other colleges in examination-evaluation process	6
Exposure to global standards (H)	H1	Interactions with well established institutions	7
	H2	Visits to some advanced multinational organizations	7
	H3	Access to internet facility	9
Policy of fairness (I)	I1	Transparency in evaluation	9
	I2	Timely assessment and declaration of results	8
	I3	Fees charged to students and variations in the same	7
Faculty development (J)	J1	Number of training programmes conducted for the faculty development	6
	J2	Number of faculty members sent for higher studies	6
Library standards (K)	K1	Number of books available	7
	K2	Standard of available books	9
	K3	Number of national and international journals subscribed	7

The relationships

After establishing the "whats" and the "how's", construction of the HOQ continues with the establishment of the relationships between the customer voices and the technical requirements as well as the co-relationships among the technical requirements.

The relational matrix

Building the relational matrix, requires the analysis of relationships existing between every "what" and every "how". For example, a relationship exists between the college building and budget priorities (Figure 1.4). All relationships are categorized as strong, medium or weak. Different numbers **(1, 3 and 9 for weak, medium, and strong, respectively)** are used to signify different relationship strengths and the rational matrix is constructed. The allocation and categorization of the relationships are carried out through careful consideration. Referring to Figure 1.4, an example of a strong relationship would be between college building and budget priorities. An example of a weak relationship would be between respect for each other and budget priorities. And, an example of a moderate relationship would be between teaching experience of staff and clear and specific policies and procedures.

1.3 The correlation "roof" matrix

The correlation of "roof" matrix is constructed next. This matrix helps technical institutions specify the various technical features that have to be improved collaterally. In many ways, the roof contains the most critical information for them because it is used to balance the trade-offs when addressing customer benefits. The correlation matrix is constructed with the relationship keys. **"O"** for **positive correlation** and **"X"** for **negative correlation**. An example of a positive correlation would be between clear and specific policies and procedures and clear organization structure. There is no negative correlation identified.

The how much

Earlier, the customer voices, or the "whats" were ranked using simple averages based on the responses of participants and customer requirements are ranked on a 1 to 10 scale.

Table: 1.3 - Technical requirements and their implications for technical institutions

Sr.No.	Technical Characteristics	Implications for the technical institution
1.	Clear and specific policies and procedures	Improves overall working culture and relationships among different echelons of academic system
2.	Clear organization structure	Develops clarity on roles and responsibilities of teachers as well as students
3.	Delegation of authority	Makes the individuals responsible and motivated toward their duties. It generates sense of pride and satisfaction while performing routine work with due autonomy and flexibility.
4.	Discipline	Improves overall working culture and help in building a brand image in the competitive environment of self-finance academic institutions.
5.	Budget priorities	Optimize the resource constraints and derive maximum satisfaction of students
6.	Emphasis on continuous improvement	Update the standard of technical institution with rapidly changing technological environment and improve overall competitiveness among the academic institutions.
7.	Cross-functional collaboration	Help develop competitive benchmarks and develop the synergies for learning
8.	Suitability and relevance of curriculum	Develop the maximum benefit to students, and ultimate customer – industry, in satisfying their
9.	Participation and involvement	Improve the maximum benefit to students, and ultimate customer – industry, in satisfying their changing requirements
10.	Trustworthiness among all	Develop respectability and synergy of effort
		and knowledge
11.	Employment opportunities for students	Satisfy the ultimate customers and improve the brand image of institution in education industry
12.	Student's evaluation as an employee by the industry	Develop timely necessary modifications to the tangible and intangible areas of curriculum, discipline, attitude, building, student motivation, improvement in communication skills, etc.

This ranking is used also as a row weighting such that 10 represent the most important customer need and the greatest weight is assigned to it. A "1" represents the least important customer need and has the lowest row weighting assigned to it. A weighting factor is also attached to each relationship (a "9 for a strong relationship, a "3" for a moderate relationship, and "1" for a weak relationship) and the column weights are calculated. For example, for the first column, clear and specific policies and procedures, there is a moderate relationship with college building. The row importance weight is multiplied by the relationship weight and then summed up. Thus, the column weight for the first column is 1134. After calculating the column weights, all the technical requirements are analyzed in the light of their relative importance. After assembling all the four parts of the HOQ, namely "how's" the "what's" the relationships, and the "how much", the task of constructing HOQ is relatively complete (Figure 1.4)

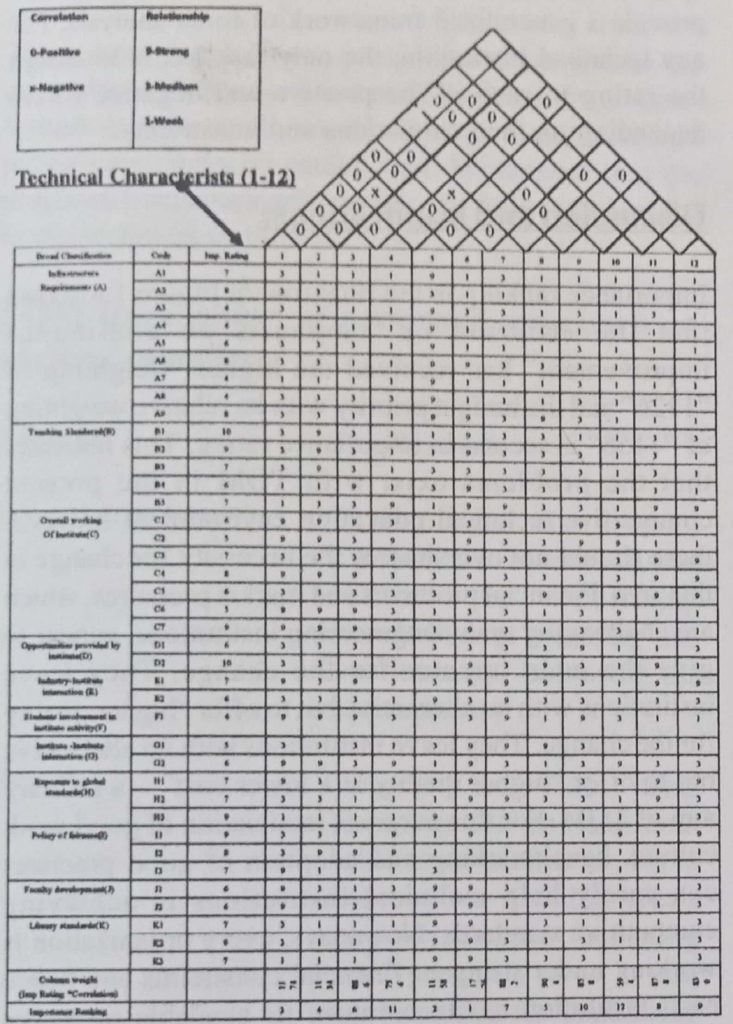


Fig.1.4 Qfd Matrix For Customer Requirment And Technical Characteristics Of Technical Institution

1.4 Implementation stages – a continuous process for QFD

The concept of QFD implementation is continuous and evolving in nature. Each phase of QFD provides the opportunity for further improvements through new comparisons towards the achievement of the ultimate goal of the system. In the present case of the technical institution the goal is to achieve certain long lasting academic standards like a coherent environment of learning and teaching, imparting value to students, fairness in examination and management policies, participation at all levels and so on. To start with the initial thrust of a QFD model, here only a first phase of development – "house of quality" is demonstrated, but a s the institution finds itself nearer to the achievement of established standards of the first phase, it can develop the comparisons and benchmarks for the second phase. For example, in the first phase of QFD, we have developed the relationships between student requirements and technical characteristics, in the same way the second phase may comprise the comparison of technical characteristics and characteristic of academic activity and hence at this stage, rating of characteristics of academic activities could be determined, and decisions related to it could be prioritized. Likewise the process continues, and further, at each stage new benchmarks could be established and opportunities for further improvement could be explored. The complete process QFD development requires a great deal of brainstorming, participation of all levels and continuous modifications. For the present case of a technical institution, the whole process is conceptualized as shown in Figure 1.4.

1.5 Knowing the barriers – a force field analysis

Implementation of TQM requires significant changes in hard as well soft issues of an organization. Primarily, the success of TQM depends on the three fundamental characteristics – commitment (to never-ending quality improvement and innovation), scientific knowledge (of the proper tools and techniques for the "technical" change) and involvement (all in one team, for the social change) (Logothetis, 2004 p. 4) In addition to these, monitoring of performance and customer satisfaction levels, identification of improvements necessary in the customer interface, tailoring output the customer's demands etc. are complex to manage. Typically, in the present case of an academic system, intangible issues like motivation, equal level of participation, willingness to change, student's involvement etc. are the barriers to the success of TQM.

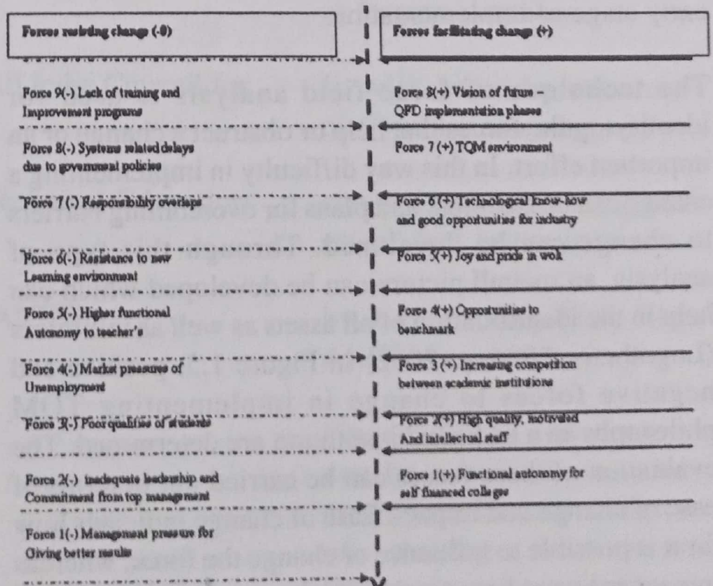


Fig.1.5 Force field analysis for TQM implementation in engineering institutions.

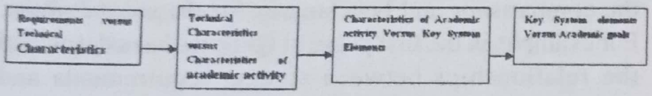


Figure 1.6 Continuous processes for QFD in engg. Institutes.

In addition, academics, of course, see themselves as being special people. Sometimes the very reason which gained them employment as an academic is indeed the characteristic which poses problems in the implementation of TQM (Idrus, 1966, p. 38). Further, in most cases, leaders of academic institutions are professors who gained seniority levels through personal achievements institutions are professors who gained seniority levels through personal achievements and who demonstrated good administrative skills. They have a good approach to cost management, human resource management and planning and organization. Many of those individuals are no longer in touch with the real world and rapidly occurring changes in the professional skills and therefore are unable to assess the challenges facing the organizations they lead. When it comes to TQM for instance this is the biggest obstacle to leaders who do not see anything wrong with the "old" and who would rather ask: "What is wrong with industry? (Zairi and Youssef, 1995, p. 32)

QFD development provides a systematic procedure to develop and implement different phases with changing maturity of organization, but knowing the influence of barriers helps in managing the disturbing elements without their omission. Looking to the earlier analysis of student requirements, technical characteristics and prioritization through QFD, a comprehensive force field model is developed to understand the severity of barriers at the early stage of implementation.

The technique of force field analysis is used for identifying the forces that help or obstruct a change or an important effort. In this way difficulty in implementing a change can be assessed, and plans for overcoming barriers to change can be developed. Through this type of analysis, an overall picture can be developed which can help in the identification of all assets as well as inhibitors (Logothetis, 2004, p. 2002) In Figure 1.5, positive and negative forces to change in implementing TQM philosophy in a technical institution are determined. The evaluation of these forces can be carried out in terms of ease of change and impact. Ease of change indicates how far it is possible to influence or change the force, whereas impact indicates how significant the consequences would be if the force were changed. A score could be assigned to each force on the rating scale by defining ease of change and impact (for example no impact, small impact, major impact). The qualification of net force effect is context specific and hence here an attempt has been made to provide a generalized framework of force analysis. For any technical institution, the only task left is to assign the rating to each of the positive and negative forces depending on their limitations and constraints.

Discussion and implications:

Importance ranking in the final row of Figure 1.4 shows that the criterion of "emphasis on continuous improvement" has received the highest weighting of "1726" and the budget priority with its relative weighting of "1158" is second in importance rating. This indicates that the problems exist with TQM in the present competitive technical education environment however these should not overshadow the necessity for change in this area. Financial problems and market pressures, which are challenging many engineering institutions, appear to give the main impetus for the change. They leave institutions with no alternative but to offer "higher quality for the change. They leave institutions with no alternative but to offer "higher quality at a lower cost" – a primary aim of TQM. For this purpose, inculcation of good work culture, benchmarking and adoption of good practices can surely help technical institutions in achieving competitive standards. Nowadays, every organization is working under stringent financial constraints and hence each institution has to optimize its available resources by deciding the budget priorities. Allocation of budget for infrastructure, student-faculty development, research facilities, library etc. varies with the maturity and future plans of the organization and hence this aspect should be handled with due care by the top management. This requires a strategic thinking of educational leaders compared to their traditional mind-sets of an administrative kind where improvement in overall competitiveness of an institution receives higher priority than the traditional importance of transferring knowledge. Likewise depending on the importance ranking of various technical characteristics for quality improvement, steps can be initiated towards development of a review and audit system. This kind of provision can assess and ensure the continuous step-by-step improvement and long-term survival of a self-financed technical institution.

In a more focused way, the implications of the proposed approach for agencies like educational institutions, faculty, students, financing bodies, accrediting body (which periodically monitor and reviews the progress of various government and private technical institutions and enjoys the authority of giving sanctions for increasing quota, opening new disciplines, starting post graduate programmes etc.) like the All India Council for Technical Education (AICTE) etc. are discussed below-:-

The present approach can provide more benefits to the upcoming self-financed technical institutions, if time-bound and logical benchmarking standards and procedures could be established. We expect that the proposed framework will provide the following benefits to the technical institutions.

TQM Implication of proposed approach on various agencies.

Agencies	Implications
Educational Sector	It improves the overall competitive of educational sector by defining, standardizing, assessing and continuously, improving the requirements.
Faculty	Initially it may induce some threat in the conventional mind set of academies, but in the long run it will be create and provide learning environment and opportunities for continuous improvements in teaching standards as well as at an attitudinal level. It helps the faculty member to develop a rapport with the students and industry by understanding their expectations and comparing the existing standards with set benchmarks.
Students	It develops faith, satisfaction and confidence in the ultimate customers that they are trained under the well-defined competitive standards and the completion of the course will help them to grow in a demanding market develops better interaction among students and helps in creating interactive group learning environment.
Alumni	Develops faith and more funds and support can be expected from former students. Satisfied students will do a better marketing for the institution and hence the biggest problem of getting good students for engineering institutions could be managed.
Financing Bodies	It helps develop trust and faith of financing bodies in technical institutions Funds could be made easily available and expansion and upgrading of infrastructure could be done easily. A well-defined way of working improves image of institution and reputation among the competing self-financed institution. This will develop the credential for their students in obtaining financial support for higher education in domestic as well as foreign institutions.
All India Council for Technical Education (AICTE)	It will provide concrete platform for assessing and comparing the upcoming and established institutions by a controlling body like AICTE research etc. Financial help and support can be provided on valid assessments based on a degree of making continuous improvements in various

aspects like infrastructure, teaching standards, faculty development, motivation for research etc.

The various levels of maturity stages for a technical institution could be defined for ranking and setting the guidelines for continuous improvement, within which each institution gets the flexibility to set, define and man oeuvre the procedures for achieving standards and benchmarks by AICTE.

- It will sensitize the institutions to student requirements, expected services and quality of education in the present, ever-changing technological environment.
- It will help the institutions in understanding the technical characteristics of engineering education and their relationships with the student's requirements.
- It will provide important insights into the existing procedures and practices to assist the effective strategic moves for the future.
- A successful implementation of framework will develop a cohesive environment in which all the entities like students, faculty members, and management can work with one vision, shared objectives and on common goals.

CONCLUSIONS:

In this research an attempt at demonstrating usefulness of TQM for engineering education. A quantitative framework of QFD is developed to support the idea in a logical manner. This comprehensive framework identifies some of the fundamental requirements and characteristics of the engineering institutions. Relationships are established and technical characteristics are ranked as per their importance. These findings will help the upcoming engineering institutions in establishing proper educational and administrative policies for the present as well as future. It is expected that the resulting relationships and prioritized characteristics will develop useful insights in to the overall development and streamlining of the limited financial flows in addition, the proposed approach of QFD captures the permanent and complete record of all the relevant information in a way that any future work could be carried out on the basis of a strong and logical platform of identified gaps and opportunities. QFD integrates the essential and crucial elements of a given system to develop positive synergy through better utilization of skill and resources.

The greatest advantage of implementing the QFD approach in engineering institution is that it encourages disciplined and detailed thinking on tangible and intangible aspects of academic activities, provokes purposeful discussion among the teachers, management and students, and at large among the various institutions, by establishing critical benchmarking standards towards continuous improvements in institutions.

In the present case all of the features of the QFD matrix are not exploited. Here an attempt has been made to develop some insights in to the customer requirements, expected characteristics of technical institutions and relationship existing among them. With a clear perception of resisting forces in implementing the model. But to get the full advantage of this frame work, an individual institution can select some two to three high-performing institutes as their competitors and bench mark its own practices on a **1 to 5 scale**, and see that how far they are able to meet the customer requirements and technical characteristics of institution, where they are standing, what quantitative gaps exists, and what steps are necessary to improve its own performance and customer (student) satisfaction rating.

In the end, we find it necessary to highlight that education differs from the manufacturing sector in a way that objectives processes, inputs and outputs are all different in nature. Managing people and recourses are no doubt the common area of concern but factors affecting performance are different. Generally profit is the indicator of measuring effectiveness of manufacturing firms but performance of an educational institute is evaluated on the basis of creation of knowledge, character building, trustworthiness of students in society etc. All of these factors are intangible in nature and hence precise objectives are difficult to set. Teaching and learning process are not the same as assembly lines. They are interactive processes between human beings who are mainly teachers and students, and therefore the procedure in the processes cannot be preset in a step-by-step format as for those for an assembly line. This understanding distinguishes the application of TQM in education where personal behavior, individual traits involved, emotions in human interaction, motives of both the parties (student& teachers) etc. are quite varying in nature. This calls for a different treatment and development of mind set while implementing TQM in education.

The other dilemma aims in implementing TQM in education is the identification of the "customer". TQM aims to enhance overall satisfaction of the customer through customer-centric design of processes and systems. Here the final recipient of academic output is the student, and lot controversies exist in adopting student as customer because of their immature age and less experienced mind-set. Frequently, the motives of student do not match with the holistic objectifies of the academic system which are long term in nature and benefits of them could only be realized after having entered in to a professional carrier. So it is necessary to practice caution in implementing TQM philosophy in education so that the sole purpose of education can be preserved and benefits of TQM could be experienced through continuous improvement.

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Bancassurance: A Win-Win Solution for Banking & Insurance Companies

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ABSTRACT

The business of banking around the globe is changing due to integration of global financial markets, development of new technologies, universalization of banking operations and diversification in non-banking activities. Due to all these movements, the boundaries that have kept various financial services separate from each other have vanished. Bancassurance simply means selling of insurance products by banks. In this arrangement, insurance companies and banks undergo a tie-up, thereby allowing banks to sell the insurance products to its customers. Bancassurance has grown at different places and taken shapes and forms in different countries depending upon demography, economic and legislative prescriptions in that country.

INTRODUCTION

As per the investigation made by Graham Morris the opening of insurance industry to private sector participation in December1990, has led to the entry of 20 new players, with 12 in life Insurance Sector & 8 in the non-life insurance sector. Almost without exception these companies are seeking to utilize multiple distribution channels such as a) traditional agencies, b) bancassurance, c) brokers and d) direct marketing.

Bancassurance is seen by many to be a significant or even the primary channel. The banking & Insurance industry have charged rapidly in the changing and challenging economic environment through out the globe. In the competitive & open environment each & every one wants to do better than others. And they know that if they are not able to provide better service won't survive in Industry. Insurance companies are also to be competitive by cutting cost & serving in the better way to customers. Now the time has come to choose and adopt appropriate distribution channel.

The insurance Industry has indeed awakened to deregulated environment in which several private companies have partnered with multinational insurance companies. Despite a billion of population, India still has a low insurance percentage of 1.95 and it is in 51st position in world. Despite of the fact that India boosts a saving rate around 25%, less than 5% is spending on insurance. To streamline the saving in to insurance bancassurance is the best channel to tackle four challenges (Product innovation, Distribution, Customer Service and Investments) facing the insurance industry?

The Bancassurance is the distribution of insurance products through the bank's distribution channels. It is a phenomenon where in insurance products are offered through the distribution channels of the banking services along with a complete range of banking & investment products & services. In simple term we can say Bancassurance tries to exploit synergies between both the insurance companies & banks. In the simple term of insurance there are only two parties:

1) The Bank
2) The Insurance Company.

Bancassurance in India: - Bancassurance in India is a very new concept, but if past gaining ground. In our country the banking & insurance sectors are regulated by two different entries. They are: -

- Banking is fully governed by RBI &
- Insurance sector is by IRDA

And bank assurance being the combination of two sectors comes under the purview of both the regulators. Each of the regulators has given out detailed guidelines for banks getting into insurance sector.

Guidelines given by RBI: - The Reserve Bank of India has given certain guidelines for banks entering into the insurance sector. They are as follows: -

- Any commercial bank will be allowed to undertake insurance business as the agent of insurance companies & this will be on fee basis with no-risk participation.
- The second guideline given by the RBI is that the joint ventures will be allowed for financial strong banks wishing to undertake insurance business with risk participation.
- The third guideline is for banks which are not eligible for this joint venture option, an investment option of

- up to 10% of the net worth of the bank or
- Rs. 50 crores. Whichever is lower is available.

The bank that wants to enter in participates in the Insurance industry they have to follow the above guidelines given by the Reserve Bank of India.

Guidelines given by IRDA: - The Insurance regulatory development & Authority has given certain guidelines for the Bancassurance they are as follows: -

- Chief Insurance Executive: Each bank that sells insurance must have a chief Insurance Executive to handle all the insurance matters & activities.
- Mandatory Training: All the people involved in selling the insurance should under-go mandatory training at an institute determined (authorized) by IRDA & pass the examination conducted by the authority.
- Corporate agents: Commercial banks, including co-operative banks and RRBs may become corporate agents for one insurance company.
- Banks cannot become insurance brokers.

Issues for regulation: Certain regulatory barriers have slowed the development of Bancassurance in India down. Which have only recently been cleared with the passage of the insurance (amendment) Act 2002. Prior it was clearly an impractical necessity and had held up the implementation of Bancassurance in the country. As the current legislation places the: -

- **Training and examination requirements:** upon the corporate insurance executive within the corporate agency, this barrier has effectively been removed. Another regulatory change is published in recent publication of IRDA regulation relating to the two licensing of Corporate agents
- **Specified person to satisfy the training & examination:** According to new regulation of IRDA only the specific persons have to satisfy the training & examination requirement as insurance agent.

Restrictive feature: A restrictive feature of Bancassurance regulation is that:

I. They appear to constrain the corporate agents to receive only commission, the profit sharing arrangements would see to be ruled out.

II. The products sold through bank channels / networks can be highly profitable and so such agreement with banks is highly beneficial for banks only.

IMPORTANT BANCASSURANCE TIE-UPS IN INDIA

There are certain tie-up between the Insurance company & banks are given at present days these tie-up are going well, running well & past in the field of Bancassurance.

(1) LIC: The insurance company LIC of India have tie up with the following bank for Bancassurance. They are:-

(A) Corporation Bank
(B) Indian Overseas Bank
(C) Centurion Bank
(D) Sahara District Central Co-operative Bank
(E) Janta Urban Co-operative Bank
(F) Yeotmal Mahila Sahakari Bank
(G) Vijaya Bank &
(H) Oriental Bank of Commerce

(2) SBI – Life – Insurance Co: The SBI life Insurance Co Ltd is starting & Running its Insurance business with the help of S.B.I.

(3) Bajaj Allianz general Insurance Co. Ltd: In the field of general Insurance the Bajaj Allianz General Insurance Co Ltd., has tie-up with Karur Vysya Bank & Lord Krishna Bank.

(4) Birla Sun life Insurance Co. Ltd: The Birla Sun life Insurance Company has a tie-up with the following bank for the insurance purpose :-

(A) Bank of Rajasthan
(B) Andhra Bank
(C) Bank of Muscat
(D) Development Credit Bank
(E) Dutch Bank &
(F) Catholic Syrian Bank

In spite of above mentioned tie-up with banks. There are many tie-ups for the purpose of bancassurance. Like ICICI Prudential, United India Insurance Co-Ltd. & so on.

The Three Development Models for Tie-ups in Bancassurance

	Description	Advantages	Disadvantages
Distribution Agreement	Bank acts as an intermediary for an insurance Company	Operations start quickly No capital Investment (Less costly)	Lack of flexibility to launch new products Possibility of differences in Corporate culture
Joint Venture	Bank in partnership with one or more	Transfer of expertise	Difficult to manage in Insurance companies the long term
Full Integration	Creation of a new subsidiary	same corporate culture	Substantial investment

ISSUES TO BE KEPT IN MIND WHILE TIE-UP

The followings are certain issues that we have to keep in mind while tie-up with bank for Bancassurance purpose:

★ Do not depend upon traditional Method: The tie-up needs to develop innovative products and services rather than depends upon the traditional tracks. The kind of products. The bank would be allowed to sell are another major issue. For example: - a complex unit-linked life insurance product is better sold through brokers & agents, while a standard term product or simple products like auto Insurance, home loan and accident Insurance cover can be handled by bank branches.

★ Clarity on operational activities : There is need to be clarify on the operational activities of Bancassurance that :-

(a) Who will do branding?

(b) Will the Insurance Company prefer to place a person at the branch of the bank?

Or

(c) Will the bank branch train and keep its own people?

(d) Who will pay remuneration of above-mentioned people bank or insurance? Company or both in some ratio?

★ Required Good Training: Even though the banks are in personal contact with its client, a high degree of active marketing skill is required to sell the insurance products. These can be possible through proper training only.

SWOT ANALYSIS OF BANCASSURANCE IN INDIA

★ On order to implement the bancassurance model in our country a lot of steps we have to taken.

★ Top professionals will have to be hired.

★ We have to study the Indians nature regarding insurance.

★ Study about lower middle as well as upper class of society & how much they are eager to adopt insurance.

★ Favorable & easy policies for the people.

★ High capital investment in infrastructure development particularly in Information Technology & Telecommunication is required

★ Creation of research & development cell is very important & adaptive task.

★ We have to study about the SWOP analysis of world in the field of bancassurance & we can take this study as base.

Advantages of Bancassurance: Bancassurance is a tool, which is beneficial to bank, customer & Insurer at a time. There are certain benefits of bancassurance are given.

From the banks point of view: -

★ By selling the insurance product by their own channel the banker can increase their income.

★ Banks have face-to-face contract with their customers. They can directly ask them to take a policy. And the banks need not to go any where for customers.

★ The Bankers have extensive experience in marketing. They can easily attract customers & non-customers because the customer & non-customers also bank on banks.

★ Banks are using different value added services life- E. Banking tele- banking, direct mail & so on they can also use all the above-mentioned facility for Bancassurance purpose with customers & non-customers.

From the Insurer Point of view: -

★ The Insurance Company can increase their business through the banking distribution channels because the banks have so many customers.

★ By cutting cost Insurers can serve better to customers in terms lower premium rate and better risk coverage through product diversification.

★ From the customers' point of view: Product innovation and distribution activities are directed towards the satisfaction of needs of the customer.

Bancassurance model assists customers in terms of reduction price, diversified product quality in time and at their doorstep service by banks.

Bancassurance- A win-win solution

Bank	Insurance Company
Customer retention	Revenue and channel diversification
Satisfaction of more financial needs under the same roof	Quality customer access
Revenue diversification	Quicker geographical reach
More profitable resource utilization	Creation of brand equity
Enriched work environment	Leverage service synergies with Bank
Establish sales orientated culture	Establish a low cost acquisition channel

ISSUES TO BE TACKLED

Given the roles and diverse skills brought by the banks and insurers to a Bancassurance tie up, it is expected that road to a successful alliance would not be an easy task. Some of the issues that are to be addressed are:

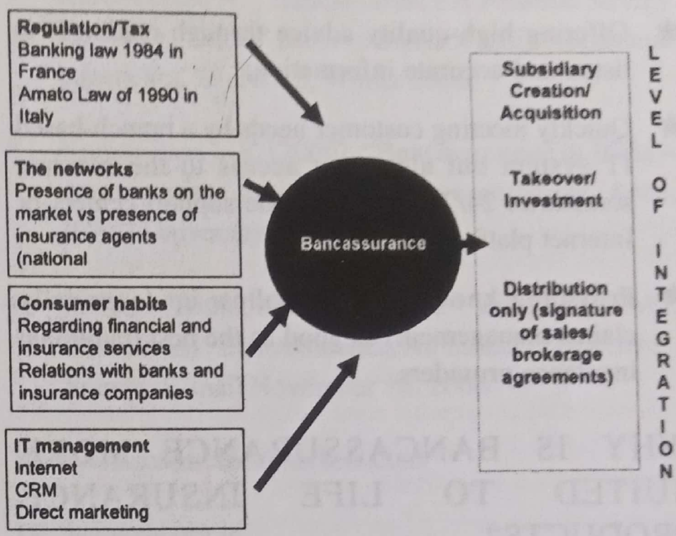
1. The tie-ups need to develop innovative products and services rather than depend on the traditional methods. The kinds of products the banks would be allowed to sell are another major issue. For instance, a complex unit-linked life insurance product is better sold through brokers or agents, while a standard term product or simple products like auto insurance, home loan and accident insurance cover can be handled by bank branches

2. There needs to be clarity on the operational activities of the bancassurance i.e., who will do the branding, will the insurance company prefer to place a person at the bank branch, or will the bank branch train and put up one of its own people, remuneration of these people.

3. Even though the banks are in personal contact with their clients, a high degree of pro-active marketing and skill is required to sell the insurance products. This can be addressed through proper training.

4. There are hazards of direct competition to conventional banking products. Bank personnel may become resistant to sell insurance products since they might think they would become redundant if savings were diverted from banks to their insurance subsidiaries.

Key success factors for bancassurance



FACTORS THAT APPEAR TO BE CRITICAL FOR THE SUCCESS OF BANCASSURANCE ARE

1. Strategies consistent with the bank's vision, knowledge of target customers' needs, defined sales process for introducing insurance services, simple yet complete product offerings, strong service delivery mechanism, quality administration, synchronized planning across all business lines and subsidiaries, complete integration of insurance with other bank products and services, extensive and high-quality training, sales management tracking system for reporting on agents' time and results of bank referrals and relevant and flexible database systems.

2. Another point is the handling of customers. With customer awareness levels increasing, they are demanding greater convenience in financial services.

3. The emergence of remote distribution channels, such as PC-banking and Internet-banking, would hamper the distribution of insurance products through banks.

4. The emergence of newer distribution channels seeking a market share in the network.

CUSTOMER SATISFACTION IS THE BASIC RULE IN BANCASSURANCE

Bancassurance operators have put the customer at the very heart of their thinking and development strategies. This means:

★ Providing a full range of financial products and services (banking and insurance) through a single sales network;

★ Offering high-quality advice through readiness to listen and accurate information;

★ Quickly meeting customer needs by a branch-based IT system but also easy access to the service, sometimes 24/7, with telephone support centers or Internet platforms;

★ Providing know-how and follow-up (especially claims management) as good as the best traditional insurance providers.

WHY IS BANCASSURANCE MORE SUITED TO LIFE INSURANCE PRODUCTS?

Traditionally, much fewer non-life insurance products are distributed through bancassurance than life insurance products. There are several reasons for this:

★ The main reason may be the complementary nature of life insurance and banking products; bank employees are already familiar with financial products and quickly adapt to selling insurance-based savings or pension products;

★ On the other hand, the non-life market requires special management and selling skills, which are not necessarily prevalent in bancassurance. In addition, such competencies require significant investment in training and motivation, and therefore additional costs;

★ Life insurance products are generally long-term products, which require customers to have complete confidence in the institution that invests their money. And we now know that, in many countries, banks have a better image and are more trusted than insurance companies;

★ Bank advisers can use their knowledge of their customers' finances to target their advice towards specific needs. This is a major advantage in life insurance and less important in personal injury insurance;

★ Some professionals also refer to the claims management aspect of personal injury insurance, which could have a negative impact on brand image. This would seem to explain why for a long time bancassurance operators hesitated to offer these types of product.

CONCLUSION:

With the opening up of insurance sector and with so many players entering the Indian Insurance Industry it is required by Insurance Companies to come up with well established infrastructure facilities with good call centre service to attract and provide information to customer regarding different good policies & their premium pay scheme.

The life Insurance Industry in India has been progressing at a rapid growth since opening up of the sector. The size of country, a diverse set of people combined with problems of connectivity in rural areas, makes insurance selling in India is a very difficult task. Life Insurance Companies require good distribution strength and tremendous man power to reach out such a huge customer base.

Where legislation has allowed bancassurance had mostly been a phenomenal success and although slow to gain pace, is now taking of across Asia, especially now that banks are starting to become more diverse financial institution and the concept of universal banking is being adopted.

In the field of bancassurance banks will bring a customer database, leverage their name, recognition & reputation of both local and regional levels. If they are using personal contact with customers and non-customers then only they can success in the field of bancassurance.

But the proper implementation of bancassurance is still facing so many hurdles because of poor manpower management, lack of call centers, and no personal contact with customers, inadequate incentives to agents and unfullfilment of other essential requirements.

Finally we can say that the bancassurance would mostly depend on how well insurers and bankers understanding is with each other and how they are capturing the opportunity and how better service, they are providing to their customers. Let us you all pay more attention towards the policies and enjoy the service provide by banks and Insurance Companies by the mode of Bancassurance.

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Automatic Learning-based MANET Cross-Layer Parameter Configuration

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Abstract

Mobile ad hoc networks (MANETs) operate in highly dynamic environments with limited resources. Current approaches to network configuration are static and ad-hoc, and therefore frequently perform extremely poorly. We describe our approach to network configuration control that relies on automatically learning the relationships among configuration parameters and maintains near-optimal configurations adaptively, even duringhighly dynamic missions. We present a case study demonstrating the feasibility of the approach. Keywords: Auto-Configuration, Cross-layer Parameter Adaptation, Learning, Mobile, Wireless Technical Area: (1) Network Parameter Configuration, (2) Heterogeneous networks

1. INTRODUCTION

Mobile ad hoc networks (MANETs) operate in highly dynamic, infrastructure-less and potentially hostile environments, with limited bandwidth and energy resources. Thus, it is desirable to adaptively allocate these resources, so that network-level performance requirements are met—in spite of inherently unreliable wireless channels and ever-changing network topology. This paper describes an approach to intelligent tuning of protocol stack parameters to automatically configure each node in the MANET. ORACLE, the Optimizing Rapidly Adaptive Configuration Learning Engine, is a unique *hybrid* approach to network configuration control, combining Machine Learning and network modelling. Analytical network models capture useful general principles, but are incomplete, incorrect, and static. Traditional Machine Learning approaches reflect actual operating conditions, but poorly transfer knowledge to new domains and objective functions. Our approach to MANET configuration relies on *automatically learning* the relationships among parameters. It maintains near-optimal configurations adaptively, even during highly dynamic missions. Our approach tunes parameters in a fully distributed manner so that a centralized processing node is not needed and communication overhead and delays are minimized. In this paper, we describe the mathematical problem formulation for MANET configuration, present the general ORACLE approach, and finally present empirical results demonstrating the feasibility of the approach.

1.1 COMPARISON WITH RELATED WORK

Adaptive techniques have been applied to improving network performance with some success. However, the points outlined below limit their utility. One parameter: Most prior approaches adjusted a single parameter, e.g. data transmission rate [5, 12, 16], congestion window [4, 13, 17], and frame length [18]. An exception is Ye *et al* [27], which optimized large numbers of network parameters; however it is completely off-line and non-mobile. One objective function: Most previous work designed models that capture parameter interactions for only one objective function, such as transmission errors [9], routing [8, 11, 24, 25] and power consumption [6, 23, 28]. Our approach does not depend on a single *a priori* objective function. Model-based design: The most notable drawback of most approaches tried in MANET is that they are *hand built* models of the interactions among parameters. This approach to network configuration is not maintainable, particularly as protocols are redesigned, new parameters are exposed, or the objective function changes. Mobility: Scalable approaches that rely on learned models of the parameter interactions were not implemented on mobile networks (e.g. adaptive routing [1], reconfigurable links [20], network parameter optimization [27]). Applications and protocols developed for the fixed, wired environment do not adapt transparently to the mobile, wireless environment [2]. ORACLE's hybrid learning methods for adaptive network configuration may be the only approach that tunes parameters across multiple layers in the protocol stack, with fully distributed local control and decision making, in a mobile ad-hoc network.

2 PROBLEM FORMULATION

Consider a MANET having N heterogeneous nodes; each node i has a set of mi *control parameters*, denoted $xi,(xi1;xi2; : : : ;ximi)$, e.g. data rate at the PHY layer, maximum number of retransmissions at the MAC layer, and hello interval for neighbourhood discovery at the routing layer. Control parameters are intentionally exposed by the protocol stack for tuning; cross-layer issues are implicitly captured by selecting control parameters from multiple layers. Each node i also has a set of *ni observables*, denoted yi ,($yi1;yi2; : : : ;yini$). Observables include context that can be observed, such as throughput, latency, network topology, application start/end and mission context.Note that there may be *unobservable* contextual information, denoted z. To capture changes over time, denote x$i(t)$ to be the value of xi at time t, and x$i(t; :::; t0)$, (x$i(t)$;x$i(t+1)$; : : : ;x$i(t0)$); do likewise for yi and z. Associated with the MANET is a real-valued scalar measure $J(t)$ that characterizes global, network-wide performance at time t. $J(t)$ could measure some combination of throughput, latency, mission requirements, user needs and other relevant factors. This measure is assumed to be a function f of all the control parameters, observable parameters, and unobservable factors: $J(t) = f(8i\ 2\ N$(xi(0; : : : ; t);yi(0; : : : ; t ¡ 1));z(0; : : : ; t)). An exact analytical expression for f is difficult to obtain, due to unobservable factors and complex cross-layer and cross-node interactions. The ultimate goal is to solve the following distributed optimization problem: Design a fully distributed algorithm where every node i determines its control parameter values x$i(t)$ using only its own previous control values and observables xi(0; : : : ; t ¡ 1);yi(0; : : : ; t ¡1) such that $J(t)$ is maximized for each t, despite the lack of an exact analytical expression for f . The algorithm design includes selecting observables; e.g., it may be useful to share the previous control settings of nearby nodes (x$j6=i(t0 < t)$).

3. ORACLE APPROACH

ORACLE builds a model of the *performance surface* to predict MANET effectiveness as a function of observables and control settings. Each node i builds a local, memory-less approximation of f, $\hat{J}i(t) = \hat{}fi$(x$i(t)$;y$i(t)$), simplifying the problem by assuming that decisions made by nearby nodes will be observable in yi. (For example, if a neighbour increases data rate, the node will observe increased congestion.) To configure the MANET, each node selects control values that optimize performance on this surface at time t: argmaxx$i(t)$ ^ fi(x$i(t)$;y$i(t)$). (Note that the controller on

Figure 1. (a) Generic ANN; (b) a transfer function used in each node of the hidden layer. each node i will be different.) We will first describe the techniques ORACLE uses to model the performance surface and then describe issues related to training the model.

3.1 MODELLING THE PERFORMANCE SURFACE

We used artificial neural networks (ANNs) [15, 21] to learn the models ^ fi. ANNs effectively handle discontinuities in the performance space, outliers in the data, and models with unknown functional forms. Once trained, ANNs calculate the function quickly, ensuring their utility in the MANET environment. An example is shown in Figure 1; each node in the hidden layers has a transfer function shown on the right. Observables and control parameters form the inputs to the ANN. Observables may include mission traffic, channel gains, fading parameters, and noise levels. Control parameters may include transmit power, data rates, and modulation schemes. The output of the ANN is the predicted MANET effectiveness. MANET effectiveness metrics could measure combinations of factors such as throughput, battery life, latency, and application quality of service. The case study below describes the exact implementation of the ANN for our experiment. A significant challenge for ORACLE is to accurately model the *extremely large search space*—perhaps as many as 1000 control parameters per node. To address this challenge, we designed a hybrid learning approach that leverages existing analytical models to learn only the *error* in the analytical models (shown in Figure 2)—thereby tackling a more feasible problem. This approach enables ORACLE to effectively capture the rich complexity of the domain and transfer learned knowledge from one environment to another. Given that analytical models are relatively rare and specific to a problem, ORACLE can use models in multiple places with different forms and advantages: Statespace reduction: e.g. relevant parameters, current operating space Feature construction: e.g. coarse estimate of MANET effectiveness, cross-layer interactions within learned models: e.g. changing the form of the model. Guidance for optimization: e.g. constraints; principal variables In the experiments below, constructed features provided a coarse estimate of global MANET throughput. A key design requirement for MANET is to limit the amount of control knowledge that is shared among nodes. In the experiment, the only information shared among nodes is the measure of global MANET effectiveness. *All* other observables and control values are *local* observations on the node. Each node learns a model of how local observables and local control parameters affect global MANET effectiveness.

4 CASE STUDY

We conducted an experiment to demonstrate the feasibility of ORACLE's learning approach to the MANET configuration problem. Our goal was to have each node independently observe *local* operating conditions and select the best parameter values to optimize *global* MANET performance.

4.1 EXPERIMENT DESCRIPTION

We performed our experiments in OPNET using a simplified Lakehurst scenario (a test site now commonly used in American MANET research [3, 22]). Six vehicles (nodes) moved in a ring of five waypoints around a stationary command centre, as shown in Figure 3. We simulated a four-stage battle, with different mobility and communication parameters in each stage, as shown in Table 1. We used 802.11 MAC and the AODV routing protocol. We built one learning controller for each node. The controllers used local information to decide control settings across multiple layers of the stack: Network Layer: Hello advertisement interval at 1, 4, and 8 seconds; MAC: maximum number of retransmissions at 2,4,8; PHY: transmit power levels implicitly controlled in 802.11b by varying data rates of 1, 2, 11 MBps.

Figure 2. The performance surface as a function of *n* dimensions of observable parameters and *m* dimensions of control parameters. Analytical models guide the empirical learner, speeding the learning process. 6 mobile nodes 5 waypoints 1 stationary node

Figure 3. Simplified Lakehurst scenario. Phase Mobility / Data 1 - deploy No motion, 1024 byte packets, constant bit rate (CBR) 2 - shape Slow mobility (5 minutes between waypoints), 100 byte packets, CBR 3 - decisive ops Fast (1 minute), 100 bytes, CBR 4 - consolidate No motion, 1024 bytes, CBR

Table 1. Simplified Lakehurst experiment: mobility and communication parameters.

4.1.1 Training Data. We collected 117 files of training data, of the 33£7 = 10:4 billion possible configurations. The files consisted of the 27 homogeneous cases (i.e. nodes have identical parameters) and 90 heterogeneous cases. Each node collected these local statistics: Application: velocity, heartbeatrate, packet size AODV: total route requests sent, total route replies sent, total route errors sent, route discovery time MANET: traffic sent (bits/sec), traffic received (bits/sec), delay (secs)

Radio receiver: bit errors per packet, utilization, throughput (bits/sec), packet loss ratio, busy, collision status Radio transmitter statistic: busy Wireless LAN: Control traffic received (bits/sec), control traffic sent (bits/sec), data traffic received (bits/sec), data traffic sent (bits/sec), delay (sec), dropped data packets (packets/sec), media access delay (sec), throughput (bits/sec), retransmission attempts (packets)

4.1.2 Experimental Procedure. ORACLE's goal was to optimize message global performance, as measured by MANET throughput1, calculated by the command centre. This throughput is the only non-local observable used by the learners.

We built an ANN *for each node*, as described in 1MANET throughput is the message traffic only, and does not include control traffic. Given that latencies could cause packets to 'accumulate,' we used a five-second cumulative total to mitigate measurement error.

Section 3. The inputs to the ANN were the 26 statistics listed in Section 4.1.1, plus location information as described below for each experiment. The output was MANET global throughput. Each node learned a model of how *local* observables and control parameters affect *global* performance. Training data consisted of the 117 files described in Section 4.1.1— 70% to train the ANNs, 10% to test them, and 20% to validate them. Finally, the ANNs controlled a test run. The ANN on each node observed local conditions and selected the control values that predicted the highest global MANET throughput. (Note that the ANNs did not change during the run, and hence calculated values extremely rapidly.) In Experiment #1, below, we demonstrate that a completely distributed learning approach improves performance over common alternate approaches. In Experiment #2, we explored issues of knowledge transfer, and demonstrate that a hybrid learning approach performs better than the basic learner.

4.2 Experiment #1: Learner compared to standard approaches The first experiment asked whether the configuration problem could be solved through a learning approach, comparing a Batch Decision Learner (BDL) with the two most common approaches to configuring a MANET. The *optimal static homogeneous configuration* was the training configuration that generated the highest throughput during scenario Phase 3 (decisive ops); each node had the same configuration settings and the configuration did not change during the scenario. The *omniscient, omnipotent human "red team"* knew the mobility patterns and communication propagation properties of the environment, and could set heterogeneous configurations for the control parameters at each time stamp in the scenario. The BDL ANNs used the statistics listed in Section 4.1.1 as input, plus each node used its *current node position (x,y)*. Figures 4 and 5 show the quality of the learned models for two nodes. The x-axis shows the actual throughput for the current observations, and the y axis shows the estimated throughput. Mobility is clearly a factor in the ANN's ability to model the environment. Table 2 and Figures 6 and 7 compare the results of a dynamic learning system to the static homogeneous configuration and to the best dynamic "red team" configuration. The test environment was identical to the training environment. The learning algorithm outperforms both the human red team and the static homogeneous configuration (except for the highly optimized Phase 3).

Figure 4. Model accuracy for a stationary node.

Figure 5. Model prediction accuracy for a mobile node. 4.3 Experiment #2: Knowledge Transfer The second experiment tested knowledge transfer.We compared performance of the BDL with a Hybrid Decision Learner (HDL) when the training and testing environments are different. The hybrid learner combines analytical models with empirical models. We built a BDL and an HDL ANN for each MANET node. Training data consisted of the statistics listed in Section 4.1.1, plus each node knew the *identity* and *distance* to its closest three neighbours2. HDL had an additional feature representing an analytical model of global MANET throughput using only locally observable information; this model attempts to capture routing issues in the MANET. Each node *i* estimates global throughput T˜G according to: T˜G(*i*) = 2£åj=7 *j*=1(T˜*i j* £*Pj*7) where ² T˜*i j* is an estimate of the throughput from node *i* to 2Identity is already known through standard routing protocols; distance is calculated by sharing current location.

Phase End BDLearner Dynamic RedTeam Static Homogeneous 1 1,470,136,320 1,376,018,432 94% 929,852,352 63% 2 520,424,320 375,285,152 72% 491,068,800 94% 3 96,661,600 72,932,000 75% 97,412,864 101% 4 1,350,628,704 1,086,611,456 80% 930,668,544 69%

Table 2. MANET throughput for the three control approaches. BDL performed notably better than the dynamic red team and static homogeneous configurations. Percentages reflect performance compared to BDL.

Figure 6. MANET throughput for three control approaches. This experiment shows that learning outperforms both the optimal static setting and a dynamic human expert.

Figure 7. Cumulative MANET throughput for three control approaches. node *j*. T˜*i j* decreases as the distance between the nodes increases. ² *Pj*7 is the probability that node *j* can reach node 7 (stationary command centre). *Pj*7 = 1:0 if node *j* is less than 200m from node 7 and drops linearly to 0.0 until node *j* is farther than 600m from node 7. Figure 8 shows the distribution of throughput values as calculated by the HDL model and compared to actual throughput, showing that the model is only a rough guide to the ANN. 4.3.1 Scenario A: New Mobility. The training scenarios are as described in Section 4.1.1. In the test sce-

0 1 2 3 4 5 6 7 8 9
x 106
0
0.5
1
1.5
2
2.5
x 106 Distribution of Actual & Estimated Throughputs
Actual
Estimate

Figure 8. HDL's estimates of throughput T˜*g* provide only a very rough estimate of actual throughput *Tg*. Throughput BDL HDL Imprvmt
Phase 1 1,192,591,360 1,660,256,256 139%
Phase 2 514,967,808 566,825,728 110%
Phase 3 107,325,600 112,959,200 105%
Phase 4 1,246,363,648 1,604,278,240 129%
Total 3,061,248,416 3,944,319,424 129%

Table 3. HDL outperforms BDL by approximately 30%, showing that HDL more effectively transfers previous experience to a new domain—altered mobility patterns. nario, node 1 moved around the ring, while nodes 2 to 7 remained stationary in the upper corner. Table 3 and Figures 9 and 10 compare the results of using the BDL controller and using the HDL controller. The results show that the hybrid learning approach transfers knowledge more effectively to a new domain. The results are more pronounced in heavier traffic conditions.

4.3.2 Scenario B: New Communications Environment. For the training environment, we used a *FreeSpace* with a line-of-sight closure path loss model for terrain under normal conditions. For the test environment, we used the

Longley Rice Propagation pathloss model with these parameters: Surface refractivity at 370; relative permittivity at 7; ground conductivity at 0.002. Table 4 and Figures 11 and 12 show shows that the hybrid learner outperforms the basic learner .

Figure 9. MANET throughput for HDL and BDL.

Figure 10. New mobility patterns: Cumulative (by phase) MANET throughput for HDL and BDL. ferred to this new domain; again, the results are more pronounced for heavier traffic conditions. (In phase 3, BDL outperforms HDL, showing an opportunity for tracking the accuracy of the learned models and dynamically switching among them.) Throughout the mission, HDL successfully transferred 127% of the traffic that the BDL transferred.

5 Conclusions and FutureWork

In this paper, we present ORACLE, a distributed learning approach to tuning network configuration parameters for a MANET. We pose the problem formally and describe the techniques used to learn the relationships among configuration parameters and to adaptively optimize mission objectives. We then use simulations to demonstrate the feasibility of ORACLE as well its effectiveness in transferring learned knowledge to new

Throughput	BDL	HDL	Imprvmt
Phase 1	1,192,591,360	1,660,256,256	139%
Phase 2	527,997,536	525,056,928	99%
Phase 3	103,145,600	96,675,200	93%
Phase 4	1,259,855,616	1,627,142,176	129%
Total	3,083,590,112	3,909,130,560	127%

Table 4. HDL outperforms BDL by approximately 30%, effectively transferring knowledge to a new environment.

Figure 11. Experiment #2B shows that a hybrid learner transfers previous experience much more effectively to a new domain— altered communications conditions. (a) Throughput

Figure 12. New communications conditions: Cumulative (by phase) MANET throughput for HDL and BDL. objective functions and environments. Each node in the MANET has its own independently trained controller that observes only *local* conditions but successfully improves the *global* MANET performance. There are many avenues for further work; some of the more interesting ones are outlined below:

To update models continuously (rather than offline), performance feedback needs to be distributed correctly to the nodes. We intend to develop a rapid, low-overhead feedback mechanism using distributed averaging techniques [26, 19]. To learn models more rapidly than neural networks while still maintaining flexibility and accuracy, we intend to develop ensemble methods [7] that rely on locally-trained neural networks and multiple local regressions [10, 14] and select the most effective controller dynamically. To increase learning speed while maintaining accuracy, we will reduce the state space by determining parameter significance and sensitivity.

To improve knowledge transfer results, we will incorporate more analytical models that can be leveraged by the hybrid learner. We will also track the accuracy of the models and dynamically adjust their trust values. Acknowledgments: This work was conducted at the Honeywell Labs under IR&D funding. We also thank Jim Freebersyser and Chris Ramming for their enthusiastic encouragement.

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DEVELOPMENT OF HARYANA THROUGH ENERGY CONSERVATION

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ABSTRACT

Energy Conservation is the basic source of energy for sustainable development of a State. By conserving more energy, we are generating more energy. In this process, the extra energy generated will extend the use of existing energy for the development of Haryana. The sources of energy are endless. It is for individual to plan and implement the concept of Energy Conservation for the development of Haryana. In this paper Energy Conservation concepts like Lunar Minerals to solve Power woes, Eco-friendly cars, Down Loading Power, Solar Energy, Diesel from waste and Energy club have been presented. Implementation of these concepts will lead to less pollution, less Global Warming, reduced traffic jams and more fresh air to breath. The health and life of society will show a significant and apparent improvement – an essential input for the development of Haryana.

Keywords : Energy Conservation, Development of Haryana.

1.0 INTRODUCTION

Energy is required to perform all types of activities. Energy obeys the law of conservation of energy.

"Law of Conservation of Energy; Energy cannot be created nor destroyed."

Energy Conservation: Energy Saved is Energy Generated.

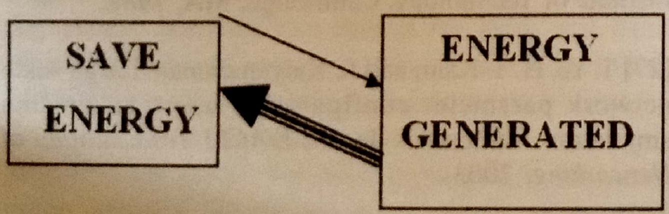

Fig. 1 Conservation of Energy

For sustainable development of Haryana, the efforts are made to reduce loss of energy and make optimal use of energy. Energy must be used to increase production. The increase in production will help raising the standard of Nath community and in turn will lead to development of Haryana.

EXAMPLE:- Population of India is 110 crores. If each one of us save one unit of energy per month, energy @ of Rs 4/-, India will save Rs 5280/- crores in a year. It is nearly the investment required to set up four NANO CAR factories. This small car will further conserve large amount of energy, reduce traffic jams and pollution. All these factors are essential to build a happy and healthy Nath society. A healthy Nath community can develop Haryana to a dream Haryana.

2.0 SOLAR ENERGY

Solar energy is the mother of all energies. Through various routes, it can be utilized for the welfare of Nath society. One convenient route is the energy from Sun is received by Solar Cells embedded in Solar Panels. It is transformed into LVDC energy. This LVDC energy is applied to electrodes placed in water tank. These electrodes contain mixture of cobalt and phosphate. Chemical catalysts are used to accelerate the production of Hydrogen. The huge quantities of Hydrogen are used to run modern gas generators. These generators have high efficiency. They produce large amount of pollution free Electrical energy, which can be used effectively for development of Haryana.

Diesel from Plastic

In the present modern age, there is constant increase in the demand of petrol. Students of Patan under the guidance of teachers have been able to produce diesel from plastic called SUKU, carbon and titanium metals at boiling point of 120° C have been able to produce 800 grams of diesel from 1 kg of suku. The cost of production is Rs 10/- per kg.

3.0 FUEL CELLS

Types of fuel cells are:- Phosphoric acid, Proton Exchange Membrane, Molten Carbonate, Solid Oxide, Methanol Fuel Cells, Regenerative Fuel Cells, Zinc Air Fuel Cells and Protonic Ceramic Fuel Cell ....

Phosphoric Acid Fuel Cell: PAFCs are largely being used in hospitals, nursing homes, hotels, office buildings, utility power plants, airport terminals, landfills and waste treatment plants. PAFCs generate electrical energy at an efficiency of 40%. 85% of the steam generated is used for cogeneration. PAFCs operate in temperature range of 150° C to 200°C. At lower temperature phosphoric acid is poor ionic conductor. CO poisons Platinum electrodes. PAFCs are being used to generate power upto 5 MW.

Lunar Minerals to Solve Power Woes

Helium-3 is being used in Fusion Reactors to generate electrical energy. This mineral is available in small quantity on our mother earth. The abundance amount of solar energy has transformed minerals on moon into He3. These minerals available on moon can generate for the energy needs of earth for 10,000 years. The huge investment being done to bring Lunar Minerals will be able to solve power woes on earth.

Eco Friendly Cars

Solar drives are being extensively researched and developed to produce eco friendly cars. An electric car uses SPV solar panels in its trolley. The energy received by solar cells will be transformed into usable electric energy by use of Maximum Power Point Trecker. The use of MPPT improves the efficiency of solar powered drives. These eco friendly cars are being used as peace mission. These cars spread the message of energy conservation awareness. It is an healthy input for the welfare of society and sustainable development of state.

Down Loading Power

It is an emerging concept. A huge grid will be created. The grid will be connected to various sources of conventional and non-conventional sources of energy. By use of ***"mouse"*** the society will be able to download the power for its welfare.

4.0 INITIATIVES OF BABA MAST NATH COLLEGE OF ENGINEERING

Under the dynamic leadership of Mahant and Dr. Markandey Ahuja, Baba Mast Nath College of Engineering is the proud Technological Institute of Nath community. For the welfare of Nath community and development of Haryana it has established nine centers of ***Excellence***. These centers of Excellence are contributing a large in the welfare of Nath society and development of Haryana.

Some Highlights

Energy Audit: The main objective of energy audit is to prepare balance sheet as per following format:

$$\boxed{\textit{Energy Supplied}} \;\downarrow\; \boxed{\textit{Actual Energy Used}} + \boxed{\textit{Energy Losses}}$$

Data is collected and efforts are made to cut down the energy losses. The energy auditors identify and quantify the inefficient processes and equipments. As per mandatory requirements, energy audit is carried out at regular intervals. Every possibility and deviation from the targeted performance is earmarked and corrective measures are undertaken.

Energy Management:

An energy manager carries out the findings of the energy audit report. A group of workers and managers work in a coordinated way. The cooperation is based on the concept of positive thinking and positive human values. These leads to effective and optimal use of energy for the welfare of Nath community.

Energy Conservation Program:

Following measures are undertaken to conserve energy;

- Establish a core group to conserve energy.
- Energy and environment audit as a regular feature.
- Periodical evaluation of energy.
- Energy analysis and its remedial measures.
- Cost benefit analysis.
- Benefits of various stake holders.

- Industry Institute Interaction. Welfare of Nath communities.
- Development of Haryana.

1.0 CONTRIBUTION OF BABA MAST NATH COLLEGE OF ENGINEERING

- To provide consultancy.
- To provide speakers for energy conservation programs.
- Consultancy to develop Energy Park and energy Club.
- Energy auditors and managers.
- Green Technology.
- Celebration of Rajiv Gandhi Akshay Urja Divas (20th August) every year.
- Waste management program for development of Haryana..

2.0 INITIATIVES OF HARYANA

Mission: Haryana means "*greenery*". The state has the mission and vision of becoming ***"GREEN"***.

Policy on Renewable Energy: Haryana is working hard to become No. 1 in developing sources of non-conventional energy. HREDA is exploring all its expertise to develop Energy Parks and Energy Clubs in the development of Haryana. The state will soon pass a resolution on the Policy on Renewable Energy. It is firm to follow Indian Electricity Reforms Act 2003.

Solar Cities: Two millennium cities Faridabad and Gurgaon of Haryana have been selected to be developed as Models of Solar Cities. All the commercial buildings and colonies will be built as per standards laid down by Bureau of Energy Efficiency. These prestigious cities will make optimum use of the available Solar Energy.

3.0 CONCLUSION

To spread awareness of energy conservation in Nath community and development of Haryana, the steps presented in this paper are Lunar Minerals to solve power woes, Eco friendly cars to reduce traffic jams and Global warming, more fresh air for the Nath community. To meet the energy needs of Nath society, measures suggested are Fuel Cells, diesel from SUKU, Energy Club, Energy Park, Solar Energy. Down Loading of Power as an ATM of energy required by Nath society. All these measures of energy conservation will go a long way for the welfare of Nath society. This in turn will lead to the development of Haryana and fulfilling its Mission of ***"GREEN HARYANA"***

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A Quantitative Software Testing Model Based Upon SDLC and STLC mapping

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Abstract:

Software testing is an important component of the software engineering, and an important link that the software development quality is guaranteed using the reasonable model for software testing. The model can reduce the expenses of developing activity in the course of testing, thus cut down the cost of software development. In this paper we put forward a model for software testing based on artifacts mapping with SDLC that run through each stages of software development cycle. We call it Quantitative Software Testing Model (QSTM) as it quantify the artifacts to be mapped during SDLC .It can find the defect in the software as soon as possible, has shorten the time taken for testing in the course of the development of software testing effectively. Finally we applied the model to the testing project which develops web site and evaluated the results.

1. Introduction

For any successful project Software testing life cycle (STLC) is equally important as software development life cycle. The key idea is to design and model STLC in order to yield maximum quality output with minimum cost incurred.

This paper primarily discusses mapping of software testing life cycle with software development life cycle .The paper defines application of testing in different software development models of testing like Spiral model, V model and W model .Main aim of efficient testing is to map basic phases of development with testing activities which in turn saves time and avoid the cost associated with bugs find in later stages. We will compare the time spent in testing with the approach discussed in this paper with conventional testing. We will prove how the mapping will result in cost cutting as well as quality improvement.

The four main process phases of Software development are requirements, specification, design and implementation .They have a corresponding verification and validation testing phase. Implementation of modules is tested by unit testing, system design is tested by integration testing, system specifications are tested by system testing and finally acceptance testing verifies the requirements. We will define how this mapping can be done and what all test artifacts can be associated with each phase. We would like to explain the phase wise execution of STLC with the SDLC and describe what could be the parall l activity and the deliverables in the STLC to gain maximum value addition.

2. Software Development Life Cycle Models from Testing Perspective

Lot of the model of SDLC is used in industry for decades depending upon project demand. The main challenge for testing was to fit with the phases of these models. There is Waterfall model, Spiral Model, 'V' Model, 'W' Model and many other upcoming models following agile methodologies too. The main aim of all the models is effective testing process for quality assurance and cost effectiveness.

The Waterfall model, V model, Spiral models etc are fatally flawed because of following factors:

- They ignore the fact that software is developed in a series of handoffs, where each handoff changes the behavior of the previous handoff
- They rely on the existence, accuracy, completeness, and timeliness of development documentation,
- They Assert a test is designed from a single document, without being modified by later or earlier documents, or
- Asserts that tests derived from a single document are all executed together.

For rectifying above mentioned issues new model need to be developed for mapping testing activities with development activities involving time to time enhancement of test artifacts as per development changes.

3. Mapping Testing activities with SDLC

In all major models of SDLC which are practiced in Software industry, there are four common phases. The four main process phases are requirements, specification, design and implementation, no matter whether the project duration is small or long.

The various basic phases involved in testing, with regard to the software development life cycle are:

- Requirements stage
- Test Plan
- Test Design.
- Design Reviews
- Code Reviews
- Test Cases preparation.
- Test Execution
- Test Reports.
- Bugs Reporting
- Reworking on patches.
- Release to production.

We have sketched – but not elaborated – testing activities in details which organize the testing effort around code handoffs or milestones. It takes explicit account of the economics of testing: that the goal of test design is to discover inputs that will find bugs, and that the goal of test implementation is to deliver those inputs in any way that minimizes lifecycle costs. The model assumes imperfect and changing information about the product. Testing a product is a learning process.

Prevention is better than cure .Testing should start early both in terms of immediate testing and planning for future testing. Planning is crucial given the time-limited nature of the testing activity (planning should be, as far as possible, integrated within design notations and formalisms.)

Mapping Testing Activities in Quantitative Software Testing Model

Here is mapping of SDLC phase with test artifacts developed and activities performed. In fact in every phase of development test has to go through its own phases of analysis, design, documentation and execution. Involving test activities from day 1 of project reduces the cost associated with bugs which are found in later stages. Now a day's testing is proactively participating in unit testing of codes also. This reduced developer overhead as well enhances tester's indebt knowledge which inturn yields quality product. Tables 1.1, 1.2, 1.3, 1.4 and 1.5 depict the testing activities during various phases of SDLC.

1. Testing activities during Requirement Analysis Phase of SDLC

Test input	Test Activities	Test Artifacts	Output
User requirements	1.Analyse Requirements 2.Revert back with doubts and queries 3.Prepare UAT	1.Requirement analysis doc 2.UAT Doc	1.UAT Doc ready for acceptance test 2.Data maintained for Requirements 3.Participation in project From initial stage hence proper time utilization

Table 1.1

2. Testing activities during Planning phase of SDLC

Test input	Test Activities	Test Artifacts	Output
Functional Specs, Project plan	1.Analyse FS 2.Revert back with doubts and queries, clarify them and log them. 3.Prepare Traceability matrix for FS and requirement mapping 4.High level test case design 5.Prepare System Test 6.Prepare Test Plan 7.Analyse feasibility of Automation	1.FS Analysis doc 2.Traceability matrix for FS and Requirements 3.High level test Cases 4.System Test Doc 5.Test Plan	1.Test Plan Ready 2.With the help of traceability requirement mapping with FS is assured 3.High level test case ready 4.System Test ready for system testing

Table 1.2

3. Testing activities during Design Phase of SDLC

Test input	Test Activities	Test Artifacts	Output
High level design	1.Analyse Design 2.Revert back with doubts and queries, clarify them and log them 3.Prepare Test Cases 4.Prepare Traceability matrix for Test cases and requirement mapping 5.Prepare integration test 6.Test lab set Up 7. Automation if required 8.Get acquainted with Technology and project architecture details	1.Design Analysis Doc 2.Low Level Test Cases 3.Automation Scripts or Code 4.Traceability matrix for test cases and requirements 5.Test Lab set up 6.Integration tests 7.White box testing doc	1. Test Cases Ready 2.Traceability matrix for ensuring that test cases are covering all requirements 3.Automation scripts ready 4.Test lab ready 5.Integration tests ready for integration testing 6.White box testing scope is clear

Table 1.3

4. Testing activities during Coding Phase of SDLC

Test input	Test Activities	Test Artifacts	Output
Requirements build up into feature	1. White Box testing 2. Unit test execution (If required) 3.Feature testing (whatever implemented) 4.Non Functional testing as mentioned and decided in test Plan doc 5. Bug Tracking, logging regression. 6. Test Case execution as well as updating in case more details are extracted from code. 7.Maintain Bug and test case traceability matrix	1.Test Pass 2.Unit Test case Results 3.Bugs in some bug tracking tool 4.Automation test results 5.Traceabilty for bugs per functionality and test cases 6.Functional /Non Functional testing for feature developed	1.Code unit tested 2.Functional/non functional Testing on individual feature 3.Traceabilty for ensuring that bugs corresponding to test case 4. Updation of test case. 5.White box testing for code flaws

Table 1.4

5. Testing activities during Testing Phase of SDLC

Test input	Test Activities	Test Artifacts	Output
Application as whole +Regression of issues	1.Use the artifacts developed in initial phase and execute them e.g. a)UAT for user acceptance test b)System Test for System Testing c)Integration Test For Integration Testing d)Automation scripts (If any) e)Unit Tests for module level testing d)Functional/Non functional testing of application as defined in Test plan	1.UAT Results 2.System Test Results 3.Integration Test results 4.Automation test scripts results 5.Bug Status 7.Test Summary Reports	1. Test Summary reports ready for deciding the application quality as defined in exit criteria mentioned in test plan. 2.Test Metrics and process improvements made

Architecture of QSTM :

Figure 1 illustrates architecture of QSTM

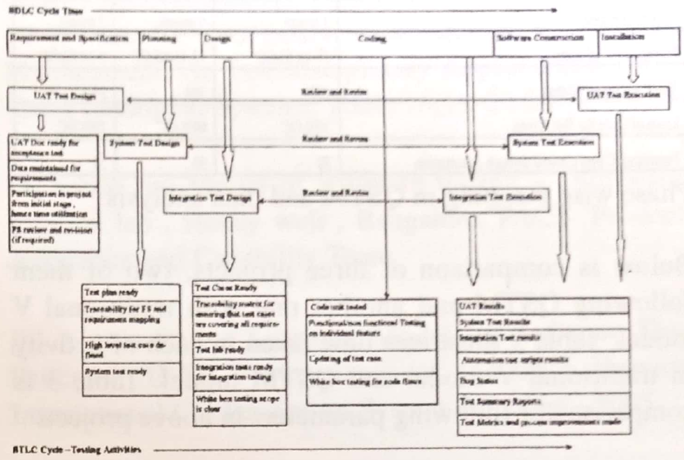

Fig 1: Quantitative Software Testing Model

Quantitative Software Testing Model :

Experimentation Results

In the final section of this paper we would like to share some of the projects where we followed the approach mentioned defined in Quantitative Software Testing Model. Though not followed with extreme strictness and knowledge of using model, we have saved lot of time and cost.

Project Description:

The above methodology was followed in three projects based on same technology, architecture and duration. The projects were web based project involving following technology/language

- C#
- Flash
- JS, CSS
- SQL
- HTML , XML, XSLT
- Content management tool.

The objective of project is to design campaign for brands which has to be done within span of 3-4 months and the campaign (Web site) goes live after that. All the projects are short duration projects. The data is taken from TCS Projects executed for reputed client.

We compared the output of Quantitative Software Testing Model with the project which was executed earlier using V model.

Parameters	Project 1	Project 2	Project 3
Project Duration	3 month	4 month	3 month
Project lines of Code	10-12 KLOC	13-15 KLOC	8-10 KLOC
No of test cases Written	400	500	350
Lines of Code for Test Client	300LOC	600LOC	200LOC
Percentage Cases covered through Automation	50	50	50

Phase wise mapping in QSTM and data analysis

Below is comparison of three projects, two of them following QSTM and another one with traditional V model. Table 2 illustrates time taken in each of activity in traditional V model and QSTM model. Table 3 is comparison of following parameters in above projects

- Total No of defects
- Defects in Coding Phase
- No of defects raised from Regression Testing

Schedule slippage for project (Days)

S.N	SDLC Activity	STLC Activities for project with QSTM	Time taken for each activity in three of the sample projects (in days)					
			Project1 -QSTM		Project1 -QSTM		Project -V Model	
			SDLC	STLC	SDLC	STLC	SDLC	STLC
1	Requirement and Specification	UAT and Activities depicted in fig 1.1 of QSTM	7	7	10	10	7	5
2	Planning	System Test and Activities depicted in fig 1.2 of QSTM	7	7	10	10	7	5
3	Design	Integration Test and Activities depicted in fig 1.3 of QSTM	8	8	10	10	8	7
4	Coding	Activities depicted in fig 1.4 of QSTM	25	20	35	35	25	10
5	Testing and Regression	Activities depicted in fig 1.5 of QSTM		20		20		30

Table 2: Comparison between projects with QSTM and V model

Projects → Parameters ↓	Project 1- QSTM	Project 2- QSTM	Project 3- V model
Total No of defects	500	600	800
Defects in Coding Phase	200	200	100
No of defects raised from Regression Testing	20	25	125
Schedule slippage for project (Days)	0	0	10

Table 3: Resultant data from three different projects

Here is graphical representation of results from above data.

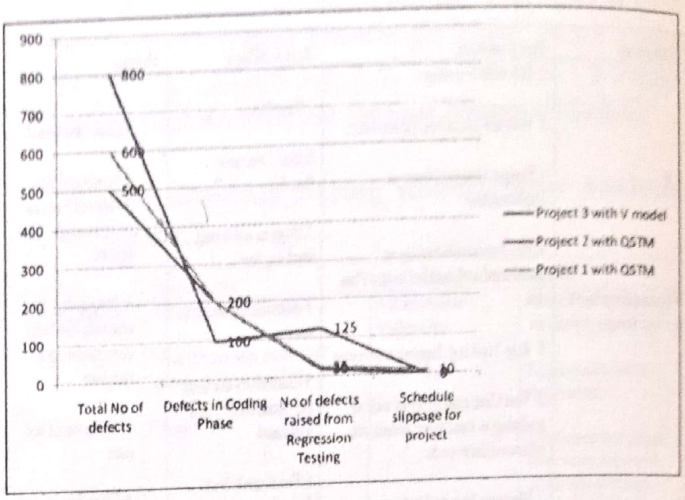

Figure 2- Graphical representation of results

Conclusion:

Following is conclusion drawn based on above data:

1) The defects were identified in early phase in QSTM, which results in better product for next phase and hence overall defects count was decreased.

2) No of defects were minimize after applying QSTM , which in turn saves the dev cost to work on defect.

3) Defects found in coding phase added to cost of project as later on rework cost in changing any design was reduced.

4) As testing was involved from day one in QSTM, the testing phase itself took less time. Thus there was no schedule slippage and on time delivery was maintained.

5) As the software was under test from beginning, the quality was monitored throughout the phase. This added to overall software quality.

6) Quality of software was far much better in QSTM as test time in Testing phase of SDLC is utilized fully on testing rather than documentation. All documentation activities were done before the testing phase only.

In brief when cost and time were calculated for above mentioned projects there was phenomenal difference. The cost of Project 3 was approximately 30 percent more than project 2 and 1 and CSI (Customer satisfaction index) for project 3 was 75 percent though for project 1 and 2 were 95 percent. CSI is direct measure of quality provided to customer. Hence the QSTM applied to the project resulted in better quality and cost control.

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Total Quality Management Applied to Engineering Education
(A case study)

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Abstract

To explore the potential for adoption of TQM in Engineering education in the light of new demands and challenges posed by customer/students and the competitive invironment of engineering institutions and society. In this research paper Quality function deployment (QFD) technique is adopted and inter-relationship between various activities in teaching learning process is to be found out by preparing QFD matrix. Also identifies technical and students requirements for the modern educational set-up and provides information about the severity of various technical requirements of competitive education. Recognizes the need for continuous improvement, cultural change and effective use of financial resources to improve the value addition at each level. Develops an understanding of the issues to be addressed at each phase of TQM implementation.

Keywords *–Technical training, TQM-Total quality management, QFD-Quality function deployment, Technical requirements.*

Introduction

By using TQM Principles many facets of engg. Education also can be scrutinized and discussed. In this research Engg. Education is modeled as a system with inputs and outputs that are affected by some internal and external parameters. The major tool Employed is Quality Function Deployment (QFD) to listen to the voice of the customers (Students) QFD has found widespread acceptance in the industry as an effective tool to translated customer requirements in to product features. In this approach, several steps are followed to find out customer needs in to the production process and ensure that at each level the highest possible quality is achieved.

QFD is simply a planning tool. It begins with market research that identifies just what the customers like, which is called the voice of the customer (VOC). It is through the QFD process that the VOC is translated in to system and part requirements. QFD will be applied to study engineering education. Under the problem formulation we consider an engg. College as likes production systems, which require an input system, a processing system, and an output system.

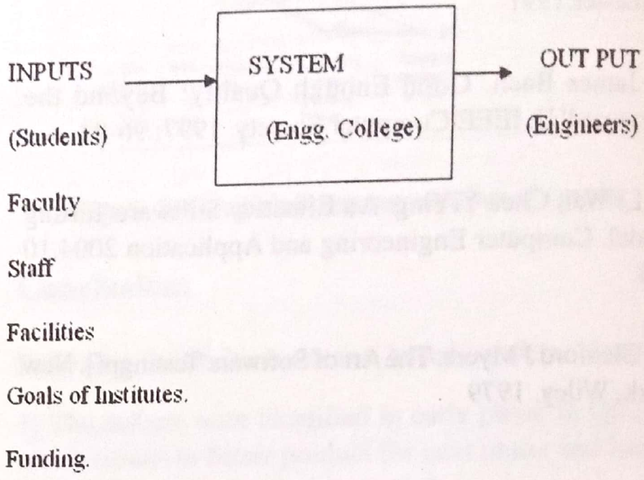


Fig.1.1

IN SYSTEM (Process activity):-

1- Training all persons.
2- Teaching methods.
3- Learning
4- advising
5- counselling
6- Tutoring and other means of help.
7- Evaluation.
8- Paperwork.
9- Infrastructure: polices, practices and politics.

Output

There are several different types of measurements that can be used as gauge performance which are listed as:-

1. Employer evaluations.
2. Percentage graduated versus percentage of entry in the programme.
3. Evaluations from graduates.
4. Job placement and advertisement.
5. Continuation education.
6. Graduate school entrance scores.

INPUTS:

Students: - Under the students we consider these as customers and apply various techniques to improve the quality of entering students i.e. pre-engineering, AIEEE exam etc.

Faculty:- It includes the educational & technical qualification of staff, technical skill, competence to research work etc.

Staff :- Under this we include the ability of technical as well as official staff members.

Facilities:- It includes services provided by institute like library, sports, training & placement cell, and other supportive environment etc.

Goal of institutes.

Funding: - It includes amount of money spent annually on various activities.

Results of Nominal Group Technique:

In order to obtain successfully the voice of the customer needed for QFD, some engineering students under M.D. &KUK University were consulted about their opinions and ideas. It was determined earlier that the primary customer is the students who attend the university. Therefore, the students should be involved in the brainstorming process to improve education. In order to obtain the students' view on the issue of engineering education, a session was conducted that used the nominal group technique.

The nominal group technique was primarily used to gain information on the students' concerns about engineering education. Because only one group of freshmen were used for the nominal group technique, the size of the sample used in this research was inadequate. Hence, the results and conclusions of this research may not be generalized beyond its limited scope. A complete cross-section of university students, administrators, faculty members and hiring companies would be needed scientifically to validate the results.

After conducting the first session, it was clear that the results obtained were not complete enough to use as customer requirements for all the QFD charts. Properly obtaining the customer requirements using the nominal group technique for a sufficient sample size would require extensive time from each of the nominal group technique participants. Instead, the results of this one nominal group technique session were used in conjunction with other sources to construct the customer requirements of the QFD charts.

The students openly voiced their concerns to the following questions: What can be done to improve the quality of education at various institutions? The term "engineering" was left out of the question on purpose due to the fact that most of the students did not have a lot of experience with the engineering segment of their education. The following list has been rearranged to show the order of finish after the voting by the students who participated in the nominal group technique session. Each student was asked to rank his or her top seven choices from the original list of responses. Responses from all students were then tabulated and added to find the final rankings that appear below:

1. Have instructors teach on the student's level.
2. Set up a computer system for real-time class scheduling.
3. Make freshman classes more dedicated to engineering.
4. Give more time for final exams (more than one week)
5. Eliminate departmental exams.
6. Work co-op programmes for all disciplines.
7. Enhance engineering advising for all students.
8. Have freer tutoring.
9. Make deed week more of a study week (too much work due)
10. Hire instructors that can be understood (language)
11. Decrease the size of large classes.
12. Increase the number of freshman advisors.
13. Have senior advisors for freshman.
14. Use textbooks that contain more examples.
15. Be able to reprimand / replace bad professors with tenure.
16. Hire more qualified lab assistant.
17. Have instructor and tutor training programmes.
18. Have a tutor in the computer labs.
19. Make the engineering schedule more flexible.
20. Improve procedures for paying tuition, financial aid, etc.
21. Increase co-operation between all departments.
22. Require fewer cluster courses.
23. Change the way that students are evaluated.
24. Base grades more on projects rather than tests.
25. Crash courses facilities for GATE, MAT, and CAT etc.

Using QFD to Improve Advising:

To obtain the voice of the customer necessary for QFD, the results of the nominal group technique session, along with personal interviews of different faculty members and administrators, plus and pertinent research was used.

The importance rating is on a **scale of 1 to 5** with 5 being the highest rating. The points used are for the **strongest relationships worth 9 points, medium worth 3 points and weak worth 1 point.** These values were suggested in the literature and are commonly used in practice. If there are no points in the box it is assumed that no definable relationships exist. The technical importance is calculated by summing up the products of the importance rating for each customer requirement and the value for the relationship symbol for each customer requirement. The design requirements with the highest technical importance are those that should receive the most attention.

In order to fill in the customer requirements part of the first QFD chart the following question was asked. What criteria would constitute an excellent advisor? The following seven points topped the list of responses.

1. Personal attention for each student.
2. Availability when needed.
3. Ability to answer academic questions.
4. Help with scheduling classes.
5. Ability to answer general questions.
6. Help keep the student out of academic trouble.
7. Understanding requirements for completion of programme.

These seven points are shown in an abbreviated from on the left side of Figure 2 which are customer requirements for advising. The next step was to fill the design requirements part of the QFD chart. To accomplish this task, it was necessary to find the answer to the following question. How can each of the customer requirements best to be satisfied? The following design requirements were obtained:

- Have more faculty involvement for freshmen.
- Involve upper class students.
- More funding for training.
- Training for advisors.
- Be available during the day.
- Use written notes of progress.
- Publish a pamphlet of helpful hints.
- Seminars

The following is a brief discussion of each of the design requirements shown in Figure 1.2 The objective target value for each design requirement is also shown in parentheses. These target values were obtained from responses by students and some faculty members in the college of engineering.

Have more faculty involvement for freshman (at least ten). If there is a sufficient number of well trained advisors and counselors, the students will be more inclined to seek help for their problems. More personal attention can be given to each student during the peak advising time of scheduling for classes.

Involve upper class students (as many as possible). As discussed earlier, the upper class students are familiar with the system and how it works. They are sometimes better qualified to answer the questions that freshman students ask. The upper class students are also around the same age level as the freshman students, therefore the freshman can receive help from a peer with whom they may feel more comfortable working.

More funding for training (Rs.300000/- per semester). This money can be used to cover the cost of training personnel to become effective advisors. It also can cover the materials required, whether they are pamphlets that are published, or rewards for top student and faculty advisors.

Training for advisors (at least one day). Without proper training an advisor can be giving the students wrong information. One should not give new responsibility to faculty members without first telling them the correct way to perform the task. With a limited number of advisors, the information given to the students is relatively consistent. By involving many more personnel, the answers to the questions are likely to become more varied without proper training or guidelines.

Be available during the day (at least eight hours). With the exception of scheduling for classes, most advisor visits are not scheduled ahead of time. The student usually drops by during a break on after his or her classes are over for the day. Since the advisor has other duties, the student sometimes finds the door locked. If the student just wanted to discuss something that was brothering him or her, or looking for some counseling, the student will probably not stop by again. It is only when the student needs something signed, that he or she will be back for sure.

Use written notes of progress (every few weeks). Written notes of progress force the students to sit down and evaluate their progress in class. If the student is having problems it is possible to detect them before mid-terms are sent home. Suggestions could be made to improve study skills, or put more time into a class before it is too late and the student must withdraw or risk failing the class. These written notes comprise a self-evaluated report card that each student completes every few weeks.

Publish a pamphlet of helpful hints. During freshman year, many different handouts are passed out give students helpful hints on how to study, how to take good notes and how to take exams. There is research available that certain methods work better than others. By placing some of this research into a pamphlet and encouraging students to use some of the techniques, good study habits can be formed at the start of their college career which will benefit them throughout their stay at college.

The relationship between the customer requirements and the design requirements were tallied to calculate the technical importance for each design requirement. The higher the value for technical importance, the more that design requirement. The higher the value for technical importance, the more that design requirement satisfies all customer requirements. The two design requirements that were viewed as the most important are involving upper class students in the advising process and using the written notes of progress as a tool to help students.

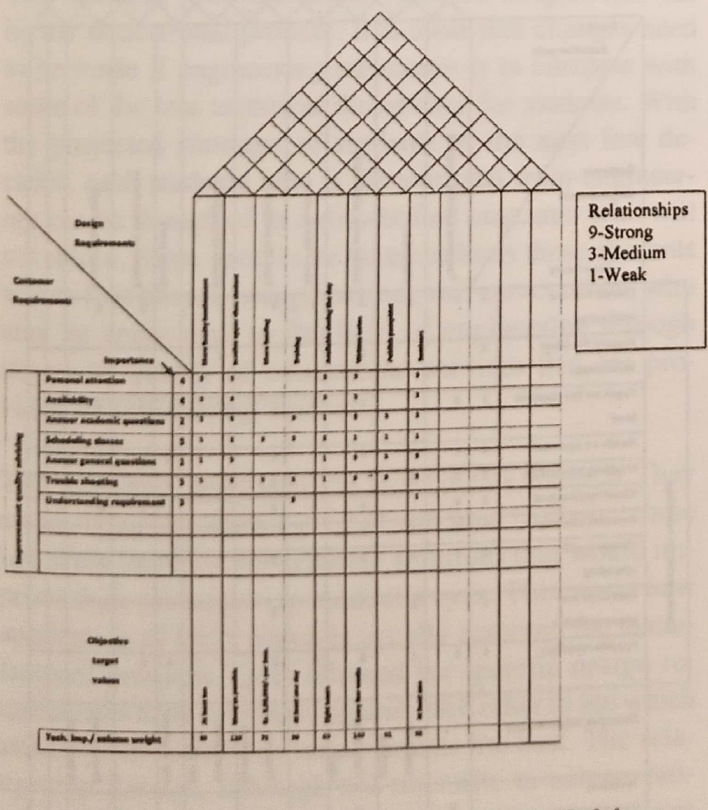


Fig.-1.2. **Requirements for Excellent Advising**

Seminar (At least one per week) seminar plays important role in improving the quality of advising as well as learning process and also improves the confidence level of students.

Using QFD to Improve Teaching:

The area of teaching is a concern not only on the college level, but also from pre-school (pre-engineering schools) through 12th grade. This research can be applied to those settings as well as a college instructor. Becoming an effective teacher is not an easy job. It takes a lot of work and effort on the part of most individuals to become skilled in the art of teaching. They must be able to understand and define their weakness, then have the ambition continually to improve and refine their skills.

The QFD chart on teaching (Figure1.3) focuses on what the students expect from classes that they attend. This chart examines the different features that go into an interesting and informative class from the student's perspective and how to achieve these goals. The customer requirements mentioned can be applied to most classes regardless of subject matter.

The customer requirements for Figure 1.3 were obtained by asking what are the requirements needed in order to have a class that is valuable for the students. Ten different ideas were generated, most were from personal experience of what made certain classes worth attending. The customer requirements for Figure 1.3 follow.

- Classes those are interesting.
- Present the latest technology.
- Teach on the student's level.
- Hands-on approach to certain topics.
- Student interaction.
- Visual applications, not all lecture.
- Personal attention.
- Classes worth attending.
- Individual and group activities.
- Provide retention.

To satisfy customer requirements, design requirements needed to be defined to fulfill the demands. The following are design requirements that were obtained by asking how each of the customer requirements can be accomplished:

- Teacher training programme.
- Class Size.
- Adopt a new philosophy (computer)
- Good textbook

- Real-life projects
- Student's research
- Group Work
- Preparing class notes.
- Presentation style.

This list seems to include many unrelated topics. A short discussion of each design requirement should clear up any confusion.

Teachers training programme. Instructors are not born effective teacher. Four years of college is usually required to teach grades one to 12. Yet one can teach on the college level without any formal training. There are many different aspects that go into becoming an effective teacher. A programme should be developed to make instructors aware of the tricks or hints that can lead to them providing the students with a better education. By sharing their knowledge of the subject, instructors that are judged as the best can help their colleagues improve their teaching skills.

Class size (less then 40 persons) the smaller the class, the easier it is to get the class involved in the discussion. By involving the students, they are more likely to pay attention and play a more active role in the learning process.

Adopt a new philosophy. Sometimes it is better to just abandon the current method of teaching a subject and try something new. It may involve using computers or some other means to enhance the lessons and teach the subject more thoroughly.

Good textbook. Each technical class should have a good text to use as a reference book. The book should be easy to read and follow with practical applications and example problems that are solved. The textbook is just one tool the student can use to learn the subject matter. The instructor should be familiar with the text and make it a point to clarify some topics that are not explained well or are confusing to the students.

Real Life Projects (two per semester). Experience from both a student and teacher standpoint has shown that projects are effective teaching tools. Most projects combine topics that are important to the class in any practical problem that must be solved. Project force the students to learn the subject matter so it can be applied to solving the problem. By having to define the problem, work towards a solution, then write up and present the results, as projects cover a board spectrum. Competing projects are just one of many tasks the students will be asked to perform once they graduate. Completing projects is also one of the few common links that engineers will find between education and working in industry.

Students research (one paper per class) In order to present the latest technology on a particular subject, the instructor can have the student's research and present certain topics. Once again this applies only to certain subjects. The research projects may be used to break up a class and change the tempo of how the class is taught each day. Research projects can stimulate interest in subjects which students would not normally be exposed to while in school.

Group work (for projects). After graduation, when the students obtain employment, most will have to work closely with their co-workers in order to perform their jobs effectively. After defining the relationships and performing the calculations necessary, few design requirements stand out:

1. Adopt a new philosophy.
2. Presentation style.
3. Preparing class notes.
4. Real life projects.
5. Teachers training programme.

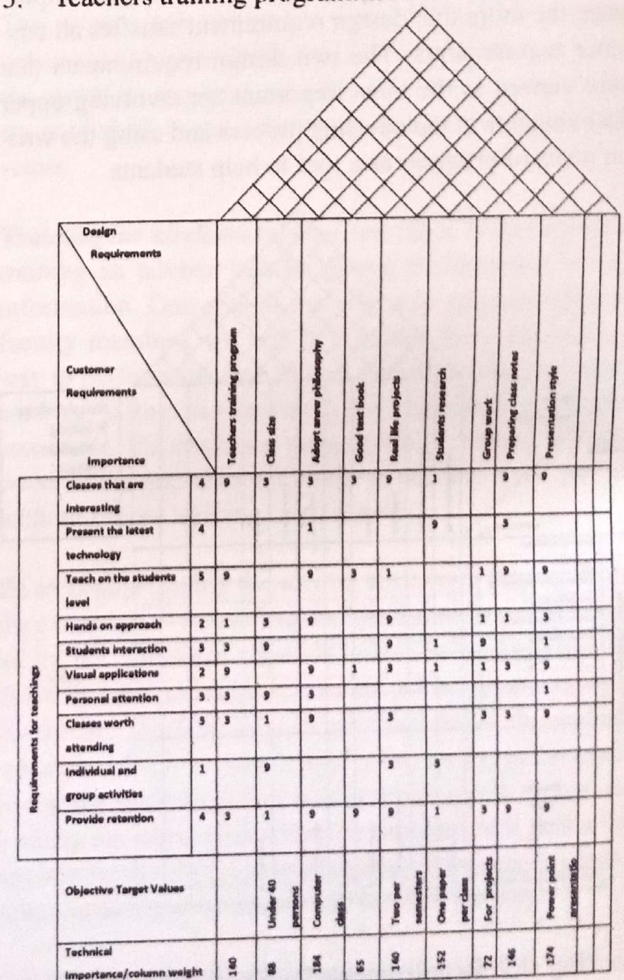
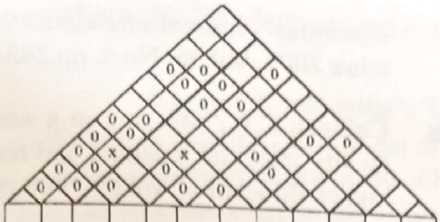


Fig.1.3 Requirements for A Well Taught Class



Improvement quality in Institute	Design Requirements / customer requirements	importance	Clear and specific policies and procedures	Clear organization structure	Delegation of authority	Discipline	Budget provision	Emphasis on continuous improvement	Cross-functional collaboration	Suitability and relevance of curriculum	Participation and involvement	Trustworthiness among all	Employment opportunities for students	Student's evaluation as an employee by the industry
	Management commitment and continuous improvement	9	1	9	9	1	9	9	9	3	3	3	3	1
	Financial resources: Allocation and utilization	8	9	3	3	1	9	9	1	3	3	1	1	1
	Physical facilities	8	3	1	9	3	9	3	1	1	3	1	1	3
	Teaching and learning methodology:	8	3	9	9	9	3	9	3	1	9	1	9	9
	R.&D.	7	1	3	3	3	9	9	3	1	1	1	9	9
	H.R. Faculty and staff	8	3	9	3	3	9	3	1	1	3	1	3	9
	H.R. students	8	3	3	1	9	3	3	3	9	9	1	9	9
	Supplementary processes	6	3	3	1	3	3	1	1	9	1	1	1	3
	Column weight		202	320	308	248	426	366	180	208	246	080	280	338
	Imp. Ranking		10	04	05	07	01	02	11	09	08	12	06	03

Fig.1.4 QFD Chart of improvement in Engineering Institute with co-relation roof

Conclusion

This research provided some valuable insights into the higher educational process. It is clear that changes need to be made if engineering education is to compete with some of the less technical disciplines for students. With the projected shortage of students in the next few decades, each students who is discouraged from engineering can be though of as a dissatisfied customer who will not return. Steps need to be taken to keep those students whose first choice is engineering, and attract others who may be undecided, to the field of engineering through improved quality of educational services that are provided to engineering students.

Two "problem" areas were the focus of this research. They are advising and teaching. QFD was used to dissect these two areas and look for possible solutions that would improve their perception in student's eyes. This was a new application of QFD which is usually reserved for manufactured products. QFD allowed for specific design requirements to be compared against each other to see which satisfied the customer's requirements the best. The relationship Ratings, although not scientific in nature, provide a basis as to which design requirements are the most important. By using QFD to record and compare all the ideas, the most valuable ideas were highlighted.

The analysis on advising had some interesting findings. It seems apparent that the students do not seek help until often it is too late. The advising system in most universities has no semester when the mid-term reports come out. The recommendation was to have written notes of progress from the freshmen students every three weeks. If these notes demonstrate that the students need help or counseling, then help can be given before it is too late in the semester.

Teaching is also an important piece in the quality puzzle. Universities need to take a closer look at some of its policies and practices to see if they are satisfying the needs of their primary students, drop out of engineering for one reason or another. It is not always because it is too hard for them. With a failure rate that approaches one out of three in engineering, changes need to be made to survive when there will be less students in the future.

In this research an attempt at demonstrating usefulness of TQM for engineering education. A quantitative framework of QFD is developed to support the idea in a logical manner. This comprehensive framework identifies some of the fundamental requirements and characteristics of the engineering institutions. Relationships are established and technical characteristics are ranked as per their importance. These findings will help the upcoming engineering institutions in establishing proper educational and administrative policies for the present as well as future. It is expected that the resulting relationships and prioritized characteristics will develop useful insights in to the over all development and streamlining of the limited financial flows in addition, the proposed approach of QFD captures the permanent and complete record of all the relevant information in a way that any future work could be carried out on the basis of a strong and logical platform of identified gaps and opportunities. QFD integrates the essential and crucial elements of a given system to develop positive synergy through better utilization of skill and resources.

It must be emphasized that since this study was conducted at the few engineering colleges, with as relatively small sample size, the results and conclusions reached in this research may not be generally true at other settings. The methodology used, however, may be replicated universally

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Inspection & Maintenance of Stacks: Proposed Guidelines

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Abstract

Chimneys and stacks are basically passive structures with few mechanical parts that require maintenance attention to keep them functional. Because of this, it is easy to overlook them. Moreover, IS: 6533-1989 (Part II), Code of Practice for Design and Construction of Steel Chimney, Structural Aspect, does not provide a comprehensive and effective inspection and maintenance schedule for steel chimneys. The intent of the present paper is to provide a basis to be used when specific or customized programs are not available. The present paper is designed to provide a useful guidance tool and set of references for those responsible for the upkeep of steel chimneys. This will include chimney owners, chimney inspection contractors and consulting engineers. Causes of deterioration and preliminaries to an inspection for steel chimneys are described. Effective inspection and maintenance schedules are suggested, which is the key to ensure long-term structural integrity, minimize maintenance expenditure and eliminate unplanned outages, resulting in significant cost savings. Finally, contents of inspection report are stated.

Keywords: *Identification plate, Inspection log, Ultrasonic thickness measurement, Torque tightening, Guy ropes*

1. Introduction

Chimneys and stacks have only one function; dispersing flue gases into the atmosphere. In the process of fulfilling this function, they are usually exposed to severe environmental conditions, high operating temperatures and extremes of heat and cold. Flue gases, with abrasive and corrosive characteristics, damage the structural materials of chimney or liner. In addition, they are dynamically sensitive and complex structures. They are different from conventional structures because they respond to cyclic components of everyday loads, especially wind. They are also often subjected to operating conditions that change over time e.g. fuel switching, duty cycling, structural modifications and changes to environmental control processes (3 L & T Inc.). Often, owners are not familiar with the effects of environmental and operating conditions, or changes in them, on the behavior of these structures, and do not recognize early signs of distress. Repair activities involving significant and unplanned expenditure are often triggered by conditions that may have been mitigated if inspection and maintenance had been performed in a timely manner (Klaus K. Kaemmer, 2005 & Bernhardt H. Hertlein, 2003).

2. Causes of Deterioration in Steel Chimneys

2.1 Lack of inspection and maintenance

Aluminium sheeting encasing mineral wool has become a common form of insulation used for steel chimneys, but it allows only limited access for inspection of the load bearing steel work. Consequently, advanced corrosion can take hold before it is noticed. In addition, the appearance of Aluminium cladding is misleading, giving the impression that all is right.

2.2 Poor design

Details, e.g. sudden changes in section thickness of various lifts of stack may lead to concentration of stresses at the interface. On their own, such local failures are not so serious but they may create a crease or ledge within the shell that traps dirt and moisture. Incorrect sizing of chimney flues and inadequate damping to resist wind induced oscillations are some of the other causes of stack deterioration (Aleksandar et. al, 2008).

3. Preliminaries to an Inspection

- An Identification Plate is to be fitted to the base of each stack to show basic information about the structure such as manufacturer, date of erection, design code followed etc. ID plates fitted to new chimneys or retro fitted to existing chimneys should also have a facility for recording the date of last inspection.
- An inspection log is to be maintained by the chimney owner summarizing previous inspection results. This should clearly state the date of inspection, modifications undertaken to the process plant or other

changes, which may affect the operation and stability of chimney. Details on the type of fuel being burnt by the plant should be available with particular emphasis on Sulphur content. In addition details of gas temperature at entry point to chimney and boiler running conditions, i.e. steady state or non-steady state, will help the contractor or consultant determine if stack is operating in such a way as to allow corrosive deposits to condense on the internal face.

4. Effective Inspections and Maintenance of Chimneys

To assist inspectors, at the base of chimney north, east, south and west aspects of stack are marked which are then followed in orienting defects found and referred to in any subsequent documentation produced. Chimneys should be out of operation during the period of inspection. Only if this is not possible and the hazards of inspecting a chimney on-line are known, so as to allow the inspection team to provide proper protective equipment, it is acceptable to inspect a live chimney. Access systems are installed in accordance with accepted trade guidelines and current codes of practice. Ladder hooks, where fitted, are closely examined during initial ascent for security of attachment and suitability for use.

Despite their common function, all chimneys are not the same. Each chimney is distinct, designed to operate effectively within specific constraints. Inspections are to be carried out only by organizations that can demonstrate competence in this type of work. The type of inspection to be undertaken will, to some extent, vary with the nature of chimney and known inspection history, but Tables 1, 2 & 3 provide guidance on general standards (Chimney Maintenance Guide, 2006, ATLAS, 2004 & Maintenance Module 12, 2007) for various types of single flue chimneys :

Table 1 – Recommended Inspection Scheme for Unlined, Un-insulated Chimneys

Annually

- Clean out any flue deposits from base of stack (can be done by chimney owner).
- Carry out close visual examination over the complete surface of the external face of shell.
- Carry out ultrasonic survey of chimney shell in sufficient detail to allow any significant loss of section to be detected.
- Tap all flange bolts & holding down bolts with a hammer to sound for any evidence of cracking.
- Check torque settings on flange & holding down bolts.
- Examine any installed lightning protection system for compliance with current standards and carry out electrical tests for continuity and resistance to earth.

4 Yearly

All Annual items +

- Remove 2 bolts from each flange or from most stressed flanges for microscopic examination for defects. Bolts should then be tested for ultimate tensile failure for comparison against rated value of new bolts.

8 Yearly

All Annual and 4 yearly items +

- Carry out ultrasonic survey on bolts securing stack to foundation to determine the extent of any corrosion present.

Table 2 – Recommended Inspection Scheme for Externally Insulated Chimneys

Annually

- Remove all accumulated deposits from the base of stack (can be done by chimney owner).
- Carry out electrical continuity checks and resistance to earth measurements on any installed lightning conductor system.

Biannually

All Annual items +

- Carry out a detailed inspection of insulation and cladding to determine its overall effectiveness and resistance to rainwater ingress.
- If internal access is possible, carry out a full inspection and take ultrasonic measurements at sufficient locations to determine if any significant loss of section has occurred.
- If internal access is not possible, cut out apertures through cladding and carry out ultrasonic thickness survey. Locations to be selected to coincide with known vulnerable areas (above flange joints, insulation collars, base plates and duct entries) and also at random intervals throughout the height of the structure. Thickness readings to be carefully plotted to match each inspection window for future comparison. Ensure that inspection apertures are adequately sealed against water ingress on completion of inspection.

- Remove flange cover boxes, where fitted, and inspect flange joints for leakage.
- Tap all flange bolts and holding down bolts with a hammer to sound for any evidence of cracking.
- Check torque settings of all bolts.
- Closely examine any installed lightning protection system for compliance with current standards and signs of physical damage.

4 Yearly

All Annual and Biannual items +

- Remove 2 bolts from each flange or from most stressed flanges for microscopic examination for defects. Bolts should then be tested for ultimate tensile failure for comparison against rated value of new bolts.

8 Yearly

All Annual, Biannual and 4 Yearly items +

- If internal access to stack is not possible remove all external cladding and insulation to enable a detailed ultrasonic thickness survey to be undertaken throughout the full height and circumference of the structure.
- Carry out ultrasonic survey on bolts securing stack to foundation to determine extent of any corrosion present.

Table 3 – Recommended Inspection Scheme for Lined Chimneys

Annually

- Carry out electrical continuity and resistance to earth checks at ground level.

Biannually

All Annual items +

- Carry out a detailed survey of the shell including for ultrasonic thickness measurement at sufficient locations to determine any areas of significant loss of section.
- If internal access is possible carry out a full inspection to determine the overall condition of the lining system.
- If internal access is not possible consideration should be given to carry out an internal inspection using a remote camera system.
- Any defective areas noted within the lining system should result in a particularly detailed examination of shell in that area.
- Defects within the lining system exposing the shell to flue gases should be rectified prior to returning the stack to service.
- Tap all flange bolts and holding down bolts with a hammer to sound for any evidence of cracking.
- Check torque settings to all bolts.
- Closely examine any installed lightning protection system for compliance with current standards and signs of physical damage.

4 Yearly

All Annual and Biannual items +

- Remove 2 bolts from each flange or from most stressed flanges for microscopic examination for defects. Bolts should then be tested for ultimate tensile failure for comparison against rated value of new bolts.

8 Yearly

All Annual, Biannual and 4 Yearly items +

- Carry out ultrasonic survey on bolts securing stack to foundation to determine extent of any corrosion present.

Guyed Chimneys

All types of chimneys described in above tables may incorporate guy ropes to retain the structure in the vertical axis. Tension monitoring and adjustment, verticality checks etc. of guy ropes are to be undertaken at the manufacturers recommended intervals and the following additional checks are to be carried out each time access to the structure is provided:

- Look for excessive corrosion in the guy ropes and ancillary fittings.
- Ensure that ropes are adequately coated with an appropriate dressing.
- Check that any rope grips installed to the system are of correct type & number, set at correct spacing, correctly fitted and are adequately tightened.

5. Inspection Reports

The Inspection Report must contain as a minimum:

- Clear and annotated photographs of all defects.
- Written description of all defects and defects plot where appropriate.
- Reasons for occurrence of defects if known and any proposed repair specifications.
- Test certificates for lightning conductor systems containing all of the information recommended within Codes of Practice.
- Relevant certificates of competence for inspection staff.

6. Conclusions

Chimneys are usually key elements in the processes to which they are linked. The consequences of their failure are very costly. Chimneys are subjected to defects that shorten their expected life. However, their effects are minimized via prudent inspection program followed by maintenance work. The practices suggested in this paper are comprehensive and well designed and can be used as a basis for implementing an adequate inspection and maintenance program. For inspections to be effective, they are to be done systematically and regularly as per recommended intervals as described in Tables 1, 2 & 3; not just when there is a breakdown or failure.

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A Quantitative Software Testing Model Based Upon SDLC and STLC mapping

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Abstract

The popular process improvement approaches (e.g., Six Sigma, CMMI, and Lean) all incorporate causal analysis activities. While the techniques used in causal analysis are well known, the concept of causality itself often is misunderstood and misapplied. The paper explores the some strategies for applying causal analysis more effectively depending upon the software application. This paper primarily focuses on action item or preventive measures for testing. It does not provide a tutorial on any specific causal analysis technique. Many different processes, tools, and techniques (e.g., Failure Mode Effects Analysis, Ishikawa diagrams, Pareto charts) have been developed for defect causal analysis. All of them have proven to be successful in some situations. Here we will apply the concept of causal analysis for improvement of test processes and areas.

The paper is based on case study of project where parameters were identified for causal analysis and then set of action items were defined to remove those defects. This ultimately leads to the defect prevention and hence adds to quality of product.

Introduction:

The Causal Analysis and Resolution process area involves the following:

- Identifying and analyzing causes of defects and other problems
- Taking specific actions to remove the causes and prevent the occurrence of those types of defects and problems in the future

Causal analysis and resolution improves quality and productivity by preventing the introduction of defects into a product. Reliance on detecting defects after they have been introduced is not cost effective. It is more effective to prevent defects from being introduced by integrating causal analysis and resolution activities into each phase of the project.

Since defects and problems may have been previously encountered on other projects or in earlier phases or tasks of the current project, causal analysis and resolution activities are a mechanism for communicating lessons learned among projects. The types of defects and other problems encountered are analyzed to identify any trends. Based on an understanding of the defined process and how it is implemented, the root causes of the defects and the future implications of the defects are determined. Causal analysis may also be performed on problems unrelated to defects. For example, causal analysis may be used to improve quality attributes such as cycle time. Improvement proposals, simulations, dynamic systems models, engineering analyses, new business directives, or other items may initiate such analysis. When it is impractical to perform causal analysis on all defects, defect targets are selected by tradeoffs on estimated investments and estimated returns of quality, productivity and cycle time.

A measurement process should already be in place. The defined measures can be used, though in some instances new measures may be needed to analyze the effects of the process change.

Case Study:

There was demand to improve the quality and reduce cost for a Test Project dealing with web based application. The objective of project was to design campaign for brands which has to be done within span of 3-4 months and the campaign (Web site) goes live after that. All the projects were short duration projects. The Company was handling multiple projects at the same time. The projects were based on same technology, architecture and duration. The projects were web based project, which involved C#, Flash, JS, SQL, CSS, XML, XSLT, HTML and content management tool. The primary aim of causal analysis was to define some action items for test team based on defect analysis which can finally lead to quality and cost control.

Advantage with above scenario:

1) In above mentioned scenario the main challenge of available data set was not encountered. As the projects were of short duration, data for almost 10 such campaigns was available in bug tracking tool.
2) As all the campaigns (Project) were having same architecture it was easy to identify common parameters for causal analysis.
3) As there were lots of ongoing projects, the action items were successfully applied to that.

Strategy:

Our causal analysis strategy addressed following elements of the causal analysis program:

Training – Explaining the concepts, techniques, and context for causal analysis. Training included following:

- Definition of causality and causal systems.
- Causal analysis techniques and tools.
- Description of the organizational context for planning and performing causal analysis, e.g., the strategy

Focus – Identification of key problem areas to be worked. Of course, some causal analysis may be triggered by "special causes", as in this case client demanded test team action items.

Action – Implementation of the recommendations of the causal analysis teams. The benefits of causal analysis are lost without timely action. Ensuring that action is taken requires the following:

- Establishing an action team that includes management and technical experts
- Scheduling regular reviews of causal analysis activities and results
- Allocating resources to implementing causal analysis team recommendations

Course of action:

The first step taken was identifying parameters which were common to all the campaigns. Here we didn't take help of any tool or technique. Analysis was done based on project architecture, SDLC cycle, Technology used and project testing and development processes.

We focused more on parameters which had feasibility to be controlled or result in some action item which can be implemented in the test cycle of the project. Following are list of parameters:

Data from different projects were analyzed for following parameters

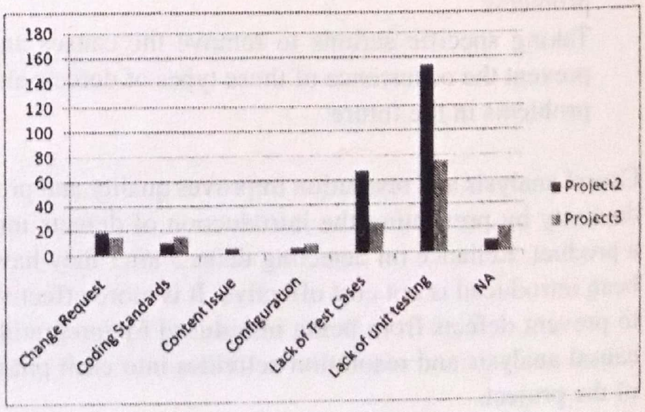
- Root cause/ Number of defects
- Resolution / Number of defects
- Number of test cases / Number of defects
- Defect Life cycle (Time taken by defect to get closed / Number of defects)
- Test efficiency to close the bug (Time taken by defect to get closed after getting resolved / Number of defects)
- Dev efficiency to resolve the bug (Time taken by defect to get resolved after getting closed/ Number of defects)
- Defect category/ Number of defects
- Defect Type/ Number of defects
- Development Area / Number of defects
- Severity/Number of Defects
- Priority/Number of Defects

1. Root cause of Defect/ Number of defects Analysis:

Root cause of defects was analyzed with number of defects in two of the projects. For root cause analysis, the bug tracking tool was already configured with one field having following options:

- Change request
- Coding Standards
- Content Issue
- Configuration
- Lack of test cases
- Lack of unit testing
- NA

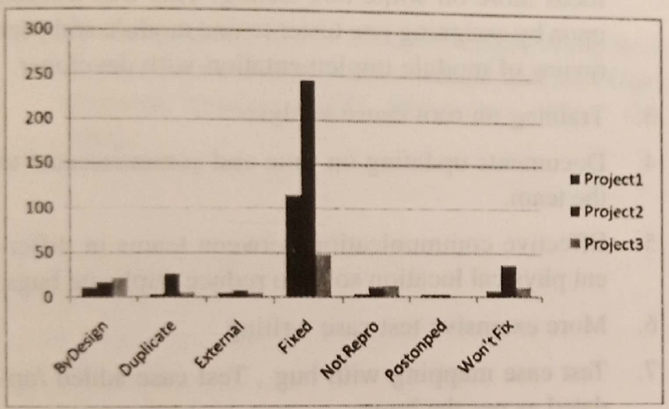
While closing the defect in tracking tool the field for root cause was mandatory. Here we relied on the knowledge of tester about root cause of the defect. Following is graphical representation of root cause analysis



Following is findings and action items for test team:

1. Majority of bugs fall into lack of test cases and lack of unit testing so there should be measures for test team to improve in this area. Test team should focus more on test coverage through test cases and assist developer in unit testing too.
2. Coding standard bugs are very less so test team should focus more on white box testing.
3. As the field of root cause in sometimes populated as NA in Bug tracking tool, inference was drawn that testers are not efficient enough for root cause analysis. Action taken was training on root cause analysis and removing NA from list.

2. **Resolution / Number of defects analysis**: Following is representation of graphical analysis in three projects:



Following is findings and action items for test team:

1. Around 20 % are closed By Design, Not Repro and won't fix so action to be taken is documents updating on time so that any design change is communicated to test.

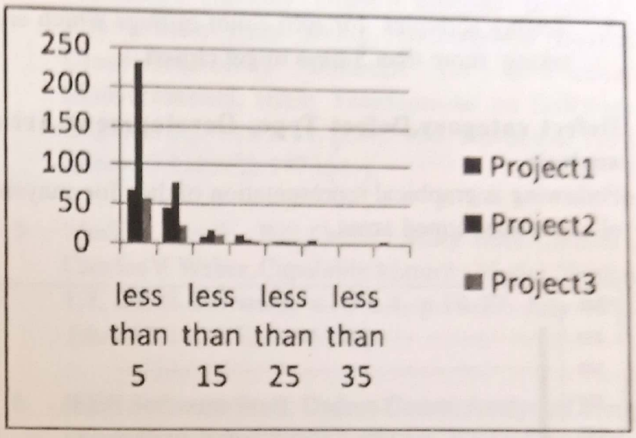
2. Duplicate bugs were more when teams were working in different physical locations. Action to be taken was effective communication between teams in different physical location so as to reduce duplicate bugs.

Number of test cases / Number of defects: Analyzing number of test cases and bug associated with it, it was found that there are 30 percent of bugs which doesn't have test cases associated with it. Following action items were defined for the same

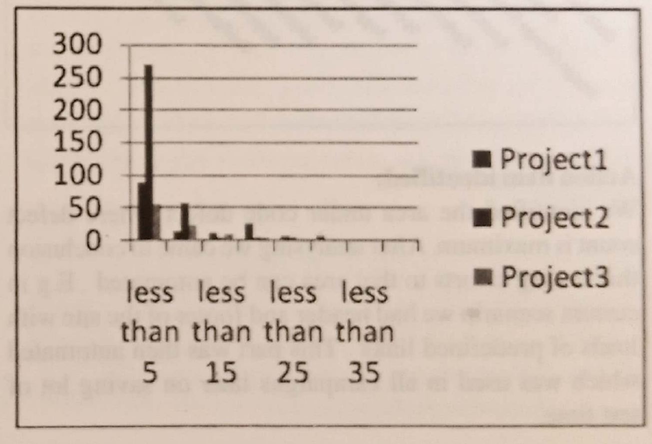
1. More extensive test case writing
2. Covering all other scenarios other than FS.
3. Test case should be added/updated corresponding to each bug logged.

4. Reusable test cases for common functionalities.

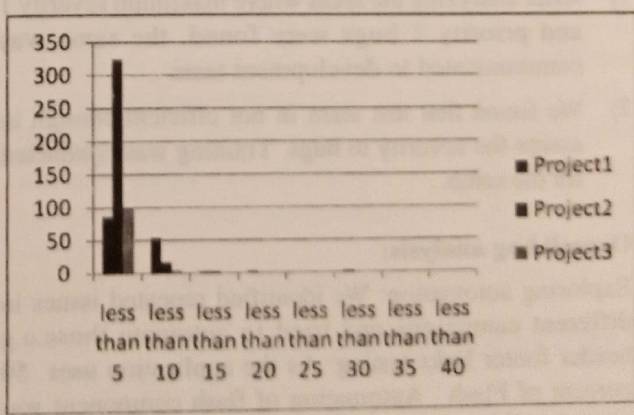
Defect Life Cycle/Dev efficiency to close the defect / Test efficiency to close the defect:
Following is graphical analysis of these parameters



Defect life cycle



Dev efficiency to close defect

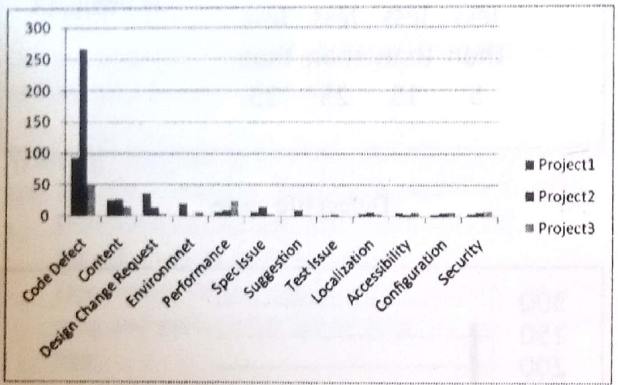


Test efficiency to close defect

Following is findings and action items for test team:

1. Defining time line for bugs to be resolved and closed.
2. Test communication to Dev for initiating activities for zero count of bugs which are taking more than 10-15 days to get resolved
3. Testing activities for zero count of bugs which are taking more than 5 days to get closed.

Defect category,Defect Type, Development Area analysis :
Following is graphical representation of data for anaysis of above mentioned areas.



Action item identified:
We identified the area under code defect where defect count is maximum. After analysing we came to conclusion that testing efforts to that area can be automated . E.g in current scenario we had header and footer of the site with loads of predefined links . This part was then automated which was used in all campaigns later on saving lot of test time.

Bug Severity and Priority analysis:

1) After analyzing the areas where maximum severity 1 and priority 1 bugs were found, the same was communicated to development team .
2) We found that test team in not efficient enough to assign the severity to bugs. Training was conducted for the same.

Overall bug analysis:

Exploring automation: We identified repeated issues in different campaigns and tried to automate those.e.g header footer links testing .As the application uses 50 percent of Flash , Automation of flash component was also identified as action item.

Conclusion:

After analysis of defects from 10 different campaigns (projects) , action items were listed and worked upon. The goal was to improve overall quality of project working on test team. Following is summary of action items

1. Measures for test team to improve in lack of test cases and lack of unit testing. Test team focus inclined more on test coverage through test cases and assist developer in unit testing too. This overall results in test quality as well as identifying defect in unit testing it.
2. Coding standard bugs are very less so test team should focus more on white box testing. This was worked upon by assigning one tester to one module and peer review of module implementation with developer.
3. Training on root cause analysis.
4. Documents updating on time and communicated to the team.
5. Effective communication between teams in different physical location so as to reduce duplicate bugs.
6. More extensive test case writing
7. Test case mapping with bug , Test case added /updated as per the bugs
8. Reusable test cases for common functionalities, this saved lot of time for new campaign.
9. Defining time line for bugs to be resolved and closed.This resulted in test and dev activity to work upon the defect and early closure of defects.This in turn reduced the regression defects also.
10. Automated of common areas like header , footer links and Flash component. The same resulted in time saving for next campaign .
11. Document on analysis of areas for severity1 and priority 1 defects was prepared and communicate to development team.
12. Training for test team for understanding the buiseness requirements and assigning appropriate priority and severity to bug. This reduces the one extra phase of bug where the priority of bug is assigned . In turn issues which are really critical are encountered timely .

The above paper was solely designed for particular project .Only thing was to focus on how we can go about *defect analysis and result in quality of project by reducing cost ,time .*

A causal analysis strategy should define when and where causal analysis should be performed. It is based on an understanding of the organization's process improvement objectives as well as its current performance levels. The causal analysis strategy helps to ensure that resources are applied systematically to important problems within the organization.

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