ANALYSIS AND MINIMIZATION OF INDUSTRIAL WASTAGES BY APPLYING QUALITY FUNCTION DEPLOYMENT (QFD)

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ABSTRACT

This paper presents a model that utilizes quality function deployment (QFD) for identification, prioritization and determination of internal customer's requirements within the Manufacturing system, so as to eliminate the wastage (Muda) occurrence. The approach used in developing the model identified the importance of recognizing signs of waste or the 'whats' in the waste HOQ. The high priority areas of waste are taken as inputs in the causes HOQ. Analysis of the HOQ highlights the wastes with high priorities; referred to as the 'whats' in the tools required for HOQ. A set of high priority tools is recommended to be used for the waste elimination. The developed QFD-waste elimination model proved to be a powerful tool for identifying, prioritizing and finding the most practical methods for getting rid of major waste in a shop floor environment.

Keywords: Quality Function Deployment (QFD); Muda; House of Quality (HOQ); Internal Customer.

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INTRODUCTION

This paper examines the causes of seven major wastes (Muda) and tried to eliminate these wastes through Quality Function Deployment (QFD) within the manufacturing industries. Muda is a Japanese expression for wastages within the manufacturing systems (Rajesh Gautam et al, 2012). One way to enhance profitability of the firm is to fundamentally trim down costs. Where improving product quality, reducing production costs and being first to market also quick respond to customers is the main criteria of enhancing profitability of the organization. There are primarily seven types of MUDA's :(Rajiv Sharma, 2012)

1. Overproduction: Producing more than is needed, faster than needed or before needed.

2. Waiting: Idle time that occurs when co-dependent events are not synchronized.

3. Transportation: Any material movement that does not directly support immediate production.

4. Processing: Redundant effort (production or communication) which adds no value to a product or service.

5. Inventory: Any supply in excess of process or demand requirements.

6. Motion: Any movement of people which does not contribute added value to the product or service.

7. Defect: Repair or rework of a product or service to fulfil customer requirements.

While in practice, elimination of muda is very specific center of attention on several key opportunities to become more efficient and therefore reduce your costs or increase your chances to be productive (make money). In any manufacturing systems primarily there are three types of activities happens, out of which two are mainly produce waste(Raid A. Al-Aomar 2011, Khalil A. El-Namrouty, 2013).

A. Steps that definitely create value: An activity is value added if and only if these three conditions are met.

- The customer is willing to pay for the activity.
- The activity must change the product, making it closer to the end product that the customer wants and will pay.
- The activity must be done right the first time.

A value added activity is one that either directly adds value to the final product or directly satisfies the customer

B. Steps that create no value, but are necessary given the current state of the system: These are the activities which are significant as per the product development concept but have no value in terms of customers eyes. As an example oiling, greasing and maintenance of machines, tool sharpening etc.

C. Steps that create no value and can be eliminated: Non value added activities are activities that do not change the form, fit, or function of the parts and activities the customer does not want to pay for them.

It is tried to analysis these wastages (MUDA) to be minimized with the QFD concepts. Quality Function Deployment (QFD) is a unique quality tool that allows businesses to plan and design products with the customers' needs in mind. QFD is a structured method for product or service planning. Quality function deployment focuses on customer expectations or requirements, often referred to as the voice of the customer (Lai-Kow Chan et al, 2002). It is employed to translate customer expectations, in terms of specific requirements, into directions and actions, in terms of engineering characteristics, that can be deployed through- Product planning, Part development, Process, planning, Production planning, Services. Quality function deployment helps identify new quality technology and job functions to carry out operations (Lai-Kow Chan et al, 2002). This tool provides a historic reference to enhance future technology and prevent design errors (Yanbin Du et al, 2013). QFD is primarily a set of graphically oriented planning matrices that are used as the basis for decisions affecting any phase of the product development cycle (Dae-Kee Minet al, 2008). Results of QFD are measured based on the number of design and engineering changes, time to market, cost, and quality.

QUALITY FUNCTION DEPLOYMENT APPROACH

Every manufacturing company providing products and goods for their customers has to recognizing their necessities and requirements in order to remain competitive in the marketplace. For this interpretation many tools, like surveys, interview, customer feedback and similar other methods are widely used for this purpose. The information gathered by the

use of these methods must be systematically transformed into technical data that will guide the planning and development processes. QFD is a quality tool which works on the use of these data produced by the various sources and transform this data into a House of quality (A.I.A. Costa et al, 2001) by which the engineering design parameters has to be extracted (Clara Cristina Usma-Alvarez et al, 2010), and the final design comes out in terms of all perspective of design (Same Yousefie et al, 2011) development and fulfilling customer demand (Adila Md Hashim, 2012).

Once collecting all the required data is reduced in creating a set of many matrices known as 'quality tables'(B. Almannai, 2008). And when these matrices are combined together forms a House of quality from which all the essential parameters are been take out and produce a quality design (Jose´ Antonio Carnevalli, 2010). This house of quality matrix has two primary elements; the horizontal part, which contains information relevant to the customer, and the vertical part, which contains corresponding technical translation of their needs (Dae-Kee Min et al, 2008). The basic process underlying Quality Function Deployment be attributing of in the centre of the matrix where the customer requirements and technical feature intersect, providing an opportunity to examine each customer's voice versus each technical requirement, for a detailed description of QFD formation process (Cor P.M. Govers, 2001).

The House of Quality is constructed with the arrangement of different matrices (G.Z. Jia, 2011) of required formation and brings them together to reach to the conclusion. These matrixes are building up through different phase.

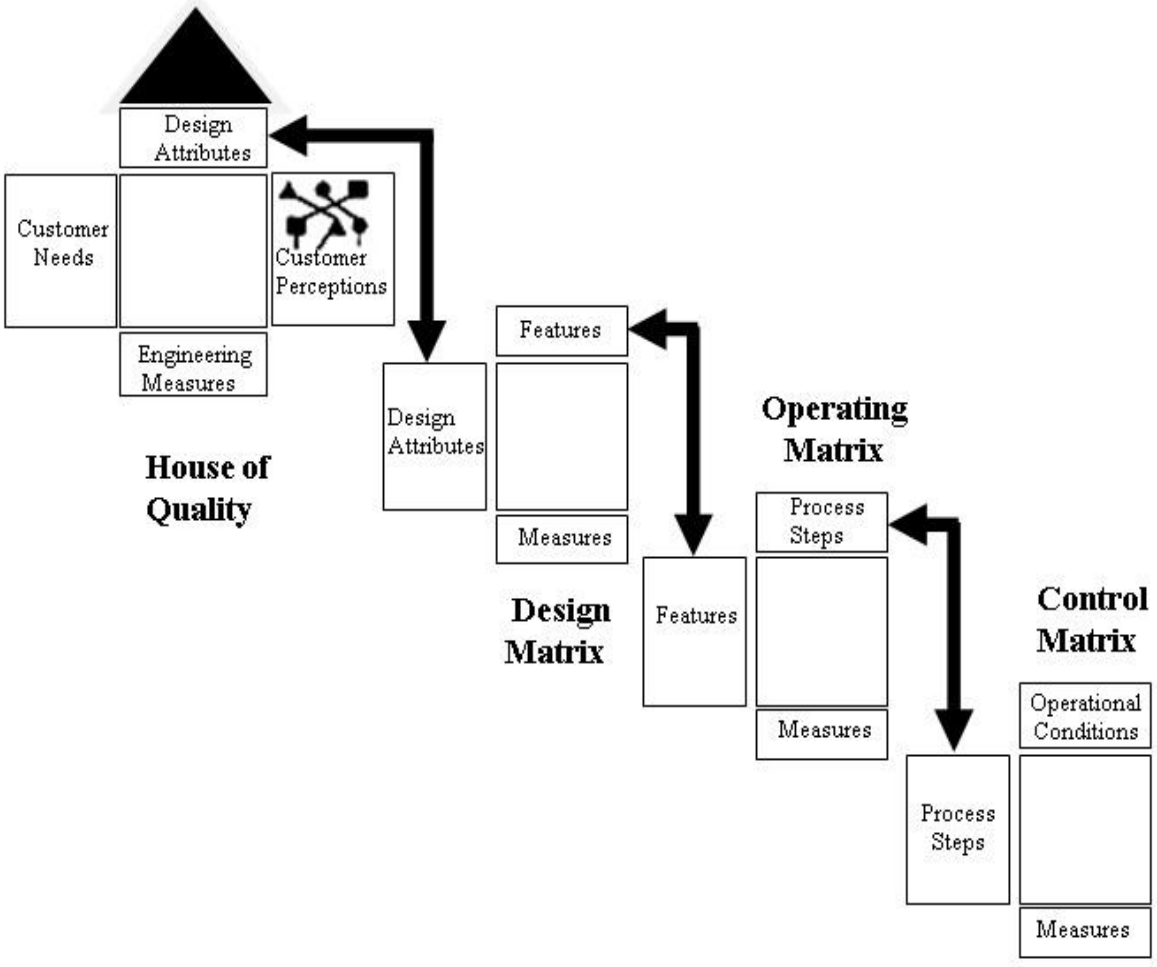

Figure 1 – QFD's Interaction Matrix (Abbie Graffin 1992)

The phases of this approach will be the establishment of "the house of quality. At the very left of house customer desires' (Whats) in the matrix is written (Lai-Kow Chan et al, 2002). It represents what the customers require, namely the necessities for the product and service features, and is also known as the "What" of HOQ. This part locates for customers to estimate whether the enterprises' products or services can satisfy customer's requirements (H. Jagdev 1997). This whats is further evaluated into Quality characteristics operation (Hows) matrix (Lai-Kow Chan et al, 2002). It means that how the enterprises should formulate services and set up management requirements to satisfy customers' demands, namely the "How" of HOQ (C.P.M. Grovers, 1996). It describes the measure of relationship between customer demands and technology or service organization requirements (Karin Bergquist, 1996) which are obligatory to satisfy customer desires, then interprets customer demands into technology or service management requirements, and designate the interrelationship between them.

LITERATURE REVIEW:

S. No.	AUTHORS	SCOPE OF STUDY	JOURNAL	YEAR	OUTCOME
1	Rajiv Sharma	Conceptual framework for improving business performance with lean manufacturing and successful human factors interventions.	International Journal for Quality research Vol. 6, No. 3	2012	Involvement of human faculty in improving performance of business organizations and reduce cost with faster delivery system by application of lean manufacturing.
2	Khalil A. El-Namrouty, Mohammed S. AbuShaaban	Seven wastes elimination targeted by lean manufacturing case study "gaza strip manufacturing firms''	International Journal of Economics, Finance and Management Sciences 2013; 1(2): 68-80	2013	Investigate and analyze the current situation of wastes elimination of the manufacturing firms in Gaza Strip and its important role for reducing the production cost; in addition it aims to promote lean thinking through studying the seven wastes that are targeted by the lean manufacturing philosophy

3	Prof.Rahul. R.Joshi,Mr. Rahul.Patil, Prof.G.R.Naik,Prof.M.V. Kharade	Through-Put Time Reduction by Lean Manufacturing	IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCEISSN: 2278-1684, PP: 40-45	2011	In this presentation it is tried to elimination of wastes through lean manufacturing and to find ways to reduce production time and cost in order to improve operating performance and product quality.
4	Abbie Griffin	Evaluating QFD's use in US firms as a process of developing products	J PROD INNOV MANAG 1992;9: 171-187	1992	In this paper author has explained the basic concept of QFD in US firms for long term development and including structuring the decision making processes across functional groups
5	Pedro Pérez Sorianoa, Salvador Llana Bellocha, & Enrique Alcántara Alcover	Partial Implementation of the Q.F.D. Methodology for the Identification of the Most Important Characteristics and Features of Gymnastics Mats Design	International Journal of Applied Sports Sciences 2006, Vol. 18, No. 2, 65-77.	2006	In this paper it is tried to identify and arrange in order of importance the needs and problems gymnasts and coaches currently find with regard to gymnastic mats. And tried to solve this problem with the QFD quality tool.
6	Sivadas Aniyan T.S., Promod V.R.	Quality Function Deployment in Manufacturing Industry (Improving the Existing SB CNC 40/60 Slant Bed Turning Centre in HMT, Kalamassery)	ICOQM-10 June 28-30, 2011	2011	In this paper the case study describes the application of QFD technique to measure the voice of the (Internal and External) customers. in Manufacturing Industry, (HMT),Kalamassery) to improve the existing SB CNC 40/60 Slat Bed Turning centre.

RESEARCH METHOD:

Immense literature is available on QFD. Which provides the specific instructions and steps of QFD of what the matrix consists and how to calculate the matrices, and others put forward the benefits of implementing QFD (Lian-Yin Zhai, 2009). In this paper it is tried to address manufacturing wastes elimination through deduce on particulars includes:

1: Does QFD really work in manufacturing Industries to overcome 7 manufacturing wastes?
2: How does QFD reduce seven wastes of manufacturing industries?
3: What factors affect QFD's utility?

The field-based qualitative research investigates these three questions through the industrial assessment. The process was split into two stages; industrial trial evaluation and practical application. The purpose of the industrial trial evaluation was to seek the manufacturing processes and identifies the wastes as well as to sort out them in seven waste categories. The practical application, on the other hand, was conducted to observe the application of the methodology which is put into practice in order to evaluate whether it is workable, gives a useful output, and practical. Furthermore, an evaluation questionnaire was applied to guide the assessment process during and after the practical application, and a record was main tend to capture any comments and note observations. The questionnaire was sort out into four sections to reflect the assessment methodology. The first three sections were designed to review the feasibility and usability at the end of each stage in the decision tool, and the final section was designed to evaluate the feasibility, usability and effectiveness of the overall process and approach. Sample questions used were "Overall, did you confirm out the production chart of priority? Do you know the work requirement of the day? Is work material is always available to you? Have you got any training to accomplish these jobs? Or what are the problems faces by you while understanding and producing cheek sheet (B. Almannai et al 2008)

House of Quality: The primary planning tool used in QFD is the house of quality. The house of quality translates the voice of the customer into design requirements that meet specific target values and matches that against how an organization will meet those requirements (Liang-Hsuan Chen And Ming-Chu Weng, 2003).

In this paper the case study of an automobile manufacturing (modifying) unit is taken as for the study. At which different cars are modified as per the requirement of the customers. First of all the requirements of the customers is obtain and listed as example " Easy to start, comfortable sitting and space, parts interchangeability, Automatic drive, five speed drive, safety and attractive design". On the bases of these inputs 'Whats' of the customer is prepared and in proceeding to this the Engineering Design Requirement is prepared in terms of 'how'. And in completion of all this 'whats' and 'How' is compared on the basis of which the House of Quality is prepared (Mehtap Dursun, 2013).

By developing the House of quality with different matrix and ranking them we will get the Engineering design requirement as "to meet Bharat Norms, feasible weight, strength of frame and structure, patterns, size and shapes. Vibration and shock absorption, electronic gadgets, and number of gears required. And on the basis of above information the house of Quality of Quality function deployment matrix is prepared which is mentioned below.

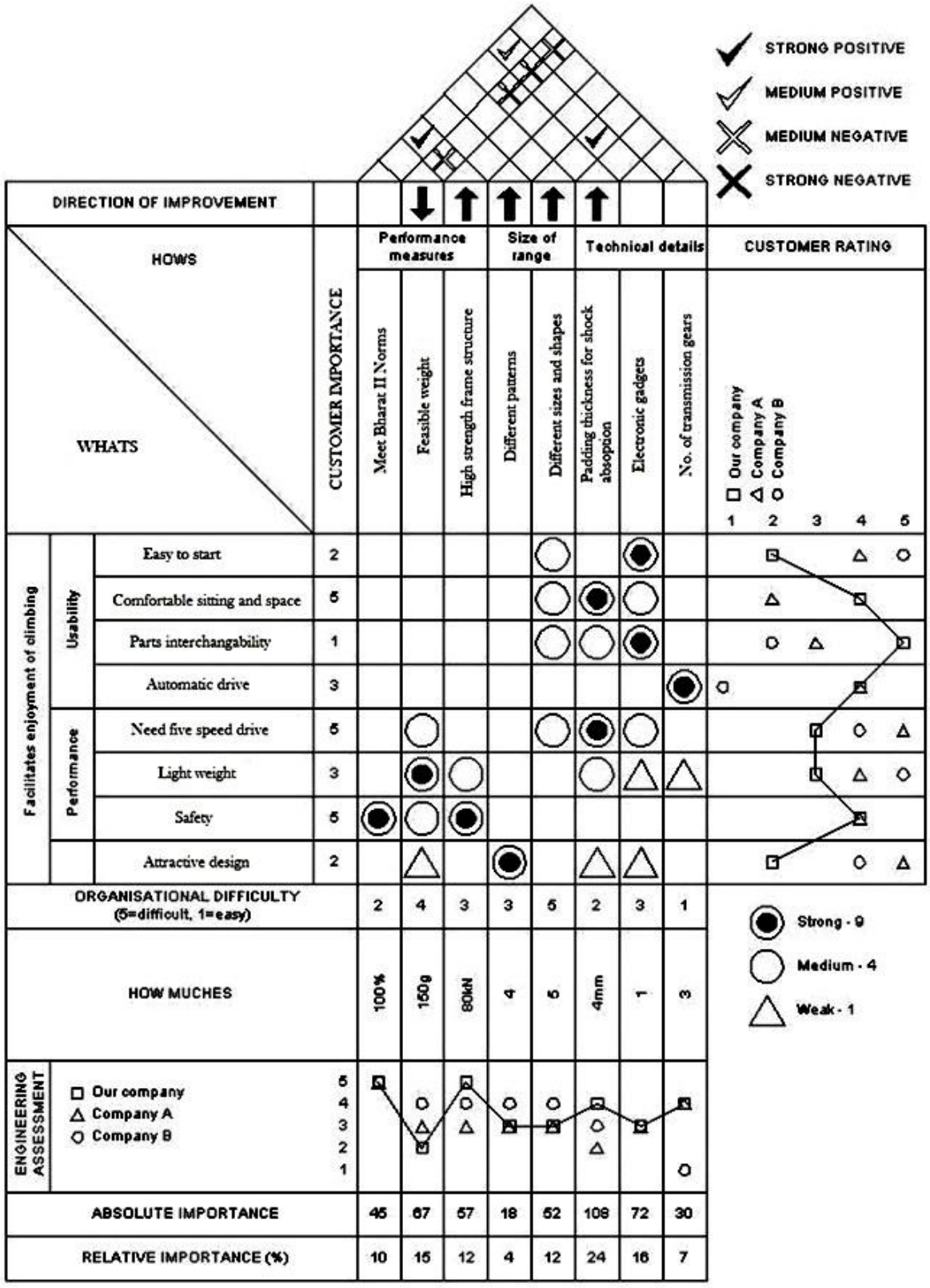

Figure 2-House of Quality(modified from Becker and Associates 2000)in survey of car manufacturing

RESULT AND DISCUSSION:

The objectives of this paper is to emphasize the significance of having a reasonable consideration of technology, organization, and customers or employees issues in manufacturing wastes, and to present a decision methodology that addressed this problem of wastes. This paper has described the development of a manufacturing waste elimination through the support tool of Quality function Deployment that is intended to support organization not only in improving their decision by addressing the right proportions of technical, organizational, and customers issues, but also to be prepared for implementation and operation unpredicted problems. Furthermore, the results from a practical application in automobile industry are presented. Overall, the results demonstrated the feasibility, usability, and usefulness of the proposed methodology. And also tried to evaluate of the manufacturing system between customers requirements with the Engineering design requirement along with the workers or employees requirement so that within the combination of all these requirements the design, decision making, planning and controlling has to be done so that within the control limit of system material has to be manufactured and designed and wastes has to be minimized to the lowest level.

CONCLUSION

This paper presents a rough idea set based on QFD approach to managing elimination of industrial wastes (muda). By using QFD design of manufacturing process is prioritized on the basis of customer requirement and maintained it. By adopting Quality Function Deployment in manufacturing techniques and systems, supported by House of Quality Asset Management Solutions, There will be reduction and/or elimination of the seven wastes of manufacturing. That's because timely information – expected at delivering visibility of materials, Work In Process, as well as automating material and process flows – is the key to improvement and becoming productive.

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