Quality Improvement in Steel Rolling Industry through Quality Function Deployment (QFD): A Case Study in Ajmera Steel Rolling, Ratlam

A. M.K. Vavdhara, B. J.S. Yadav, C. L. Yadav, D. M.K Ghosh

Abstract--The quality function deployment (QFD) theory has been developed for application in product design procedures, leading to designs that reflect customer requirements better. Moreover, QFD application to product design can achieve better communication between disciplines in a company such as marketing, design and production and it can lead to shorter design time and less engineering changes after start of production. It is well known that QFD is a powerful tool to find out the specifications of the product that satisfy customers. Quality function deployment (QFD) is a management tool that provides a visual connective process to help teams focus on the needs of the customers throughout the total development cycle of a product or process. It helps to develop more customer-oriented, higher-quality products. While the structure provided by QFD can be significantly beneficial, it is not a simple tool to use. By comparing product of different steel rolling industries we found that the quality of Ajmera Steel Rolling is poor than the other steel rolling Industries. So by applying tools of QFD it may be found out that what specifications should be improved in order to make it better. The result obtained can provide guidelines for root cause identification and quality improvement of hot rolling processes.

Keywords— Quality Function Deployment, House of Quality Customer Requirements, Quality Improvement.

I. INTRODUCTION

The product of good quality and satisfied client are the most important objectives which sets the company tending to success [1,2]. Quality in contemporary world is one of the most important tools in competition market and international trade. Aim to the possible best quality of final product is a factor, which to a great degree decides both about achievement of the customers’ confidence and about the company’s position on market [1]. To succeed in developing thriving new products or improve on existing ones is not easy. Studies indicate that as much as somewhere between 35 per cent and 44 per cent of all products launched are considered failures [3]. The result is a focus on what is wrong with the existing product or service, with little or no attention on what is right or what the customer really wants. QFD is a visual connective process that helps teams focus on the needs of the customers throughout the total development cycle. It provides the means for translating customer needs into appropriate technical requirements for each stage of a product/process development life-cycle. By contrast QFD uses a matrix format to capture a number of issues pertinent and vital to the planning process. The matrix presents these issues in an outline form, which permits the organization to examine the information in a multidimensional manner. This encourages effective decision based on a team’s examination and integration of the pertinent data.

QFD is not an easy tool to use and it has four phases to implement completely in any field. In the above work only first phase of Quality function deployment is analyzed, also it was performed only in local area. The voices collected were also not clear and easy to understand. Also there were a lot of ambiguities in the voices. As it is a team process to completely exercise the project.

II. METHODOLOGY

The success of a product or service largely depends on how they meet the customers’ needs and expectations. Consequently, more effort is involved in getting the information necessary for determining what the customer truly wants. The organization’s task is to form the strategies of the definitions of the customer’s priorities and the measurement of their satisfaction based on the quality criterion. This form of activity is connected with designing and manufacturing of product, which marks corresponding optimum level of quality determined by customers. The QFD matrix presents these issues in an outline form, which permits the organization to examine the information in a multidimensional manner. This will serve as a basis for developing an understanding of the QFD process in steel rolling industry other manufacturing industries.

1) Customer Voices

In the collection of customer voice we have taken interviews of customers and retailers. As the consumers are well known and familiar with the product so it was better to do the survey among end users. Supporting techniques in developing a Core QFD matrix included brainstorming, focus group discussions, questionnaires, and interviews. These methods allowed developing and organizing information through a structured process and providing visualization of relationships at various detail levels. The customer voices are:

- Edge of product is not good
- Shape is not uniform
- Surface quality is not better
- Corrosion problem
- Acceptance of Product
2) Translation of Customer Voices into Technical Parameters

In the voice collection it is apparent that customers’ voices follow no order. Customers do not deliver their comments in an organized manner. The first comment concerns the quality of edge, the second concerns the geometry of shape, and the next states the quality of surface, fourth voice concerns weather protection, the fifth voice concerns preferences of product.

<table>
<thead>
<tr>
<th>TABLE I</th>
<th>TRANSLATION OF CUSTOMER VOICES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edge of product is not good</td>
<td>Quality of Edge</td>
</tr>
<tr>
<td>Shape is not uniform</td>
<td>Geometry Shape</td>
</tr>
<tr>
<td>Surface quality is not better</td>
<td>Quality of Surface</td>
</tr>
<tr>
<td>Corrosion problem</td>
<td>Weather Condition Protection</td>
</tr>
<tr>
<td>Customer Acceptance</td>
<td>Acceptance of Product</td>
</tr>
</tbody>
</table>

The beginning of technical portion of the matrix is the translation of the customer’s voices into technical requirements. The voices must be translated into the type of language that the company uses to describe its products for design, processing, and manufactures at the same time.

<table>
<thead>
<tr>
<th>TABLE II</th>
<th>TRANSLATION OF CUSTOMER VOICES INTO TECHNICAL REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of Edge</td>
<td>Cutting</td>
</tr>
<tr>
<td>Geometry Shape</td>
<td>Control of charge</td>
</tr>
<tr>
<td>Quality of Surface</td>
<td>Roll leveling</td>
</tr>
<tr>
<td>Weather Condition Protection</td>
<td>Roll leveling</td>
</tr>
</tbody>
</table>

3) Customer Competitive Analysis

The customer evaluation of the performance of the competitors’ products of the surveying company was determined using a scale of 1 to 5. In this case two competitors were examined for comparing and benchmarking process. The customer competitive analysis shows that where the consumer product is today, and what the competitors are doing with respect to the customer demands.

<table>
<thead>
<tr>
<th>Customer Voices</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Customer Importance Rating</th>
<th>Customer Competitive Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of Edge</td>
<td>1</td>
<td>2.4</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>1 - Very Bad</td>
<td>1 - Very Bad</td>
</tr>
<tr>
<td>Geometry Shape</td>
<td>2</td>
<td>1.7</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>2 - Bad</td>
<td>2 - Bad</td>
</tr>
<tr>
<td>Quality of Surface</td>
<td>3</td>
<td>3.3</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>3 - Normal</td>
<td>3 - Normal</td>
</tr>
<tr>
<td>Weather Condition Protection</td>
<td>4</td>
<td>3.5</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>4 - Good</td>
<td>5 - Very Good</td>
</tr>
<tr>
<td>Acceptance of Product</td>
<td>5</td>
<td>1.2</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>4 - Good</td>
<td>5 - Very Good</td>
</tr>
</tbody>
</table>

4) QFD Metrix

Fig. 1. Customer competitive analysis

A. Quality of Edge
B. Geometry Shape
C. Quality of Surface
D. Weather Condition Protection
E. Acceptance of Product

■: Own Company
∆: Competitor 1
●: Competitor 2
Fig. 2. QFD matrix with technical requirements
Its purpose is to provide a series of technical requirements that specify a generic design that responds to the customer’s voices.

Fig. 3. Direction of customer improvement
It is helpful to record decisions about each technical requirement to show the direction that customers prefer. For every technical requirement, there is a direction that is most favorable for customers, one that will maximize their satisfaction. This information can be helpful to team when they are examining the co-relationship between technical requirements and when they are establishing targets. The symbols showing direction of customer improvement are usually placed in the matrix above the technical requirements. They have their greatest value when examining the co-relationships between technical requirements. When they are placed across the top of the matrix, they are conveniently located during co-relationship determination.

Fig. 4. Technical competitive assessment
The customer’s evaluation of poor performance of all companies is strong signal that a competitive opportunity exists. Any other companies doing similar customer research will see this same situation and the obvious opportunity. Our chief competitors are at higher positions, so we have to improve our product to best satisfy our customers.
The portion of the QFD planning matrix reserved for the results for competitive technical testing can be used in a variety of ways depending upon a team’s determination. The competitive assessment data shown in diagram can be transferred to the matrix as a series of numerical data. An alternative is to portray the data graphically another approach is to show both the data and the graphic portrayal. Observation indicates that most people find the graphic representation easiest to use when analyzing the completed matrix to establish priorities and competitive targets.

Establishing targets

If the team combines its discussion of target values and graphic plots, the concern for how to plot the data will normally resolve itself. The next figures will help illustrate this process each represents a selected piece of the QFD product planning matrix. Each shows the customer voice, importance, complaints, and competitive evaluation along with the technical competitive assessment data and the strength of relationship. Each uses the technical requirement different customer competitive evaluations and different competitive test assessment data are used in each figure to help illustrate the team decision process [4].

House of Quality for hot rolled steel has been presented (Figure 3).

The building of The House of Quality covered the following phases:

Phase I: The demands and desires of customer have been established.

Phase II: The importance of demands of customer have been classified. And also the priorities of the individual customer requirements have been established.

Phase III: The scale of the importance of own activity at customer with his requirements has been compared.

Phase IV: Fulfilled demands of customer have been assigned to corresponding parameters of product. Answers to question have been established – What does customer expect? And how will it be realized by product?

Phase V to VII: Measurable (standard) values of parameters, the possibilities of achieving the aim, difficulties in technical realization have been defined.

Phase VIII: The dependence field between phase I and phase II.

Phase IX: Comparison between company’s product and competition products – based on customer’s estimation.

Phase X: The analysis of estimation achieved by customer.

Phase XI: Comparison between company’s product and competition products – based on technical parameters.

Phase XII: The mutual dependence field between technical parameters of hot rolled steel.

Phase XIII: The critical points of sales.

Fig. 5 shows that customer voice “Quality of edge” is at 2.5 and the chief competitor is at 3.5 and the importance of this voice is 2.4, there are no complaints for this voice.

For the customer voice “Geometry shape”. The importance rating for this voice is 1.7 and on 1-5 scales our company is at 2 and the chief competitor is at 5. There is one complaint regarding this voice.

For the customer voice “Quality of surface”. The importance rating for this voice is 3.3 and on 1-5 scales our company is at 2.5 and the chief competitor is at 4. There are 2 complaints regarding this voice.
For the customer voice “Weather condition protection”. The importance rating for this voice is 3.5 and on 1-5 scales our company is at 2.2 and the chief competitor is at 3.5. There are 5 complaints regarding this voice.

For the customer voice “Acceptance of product”, the importance rating for this voice is 1.2 and on 1-5 scales our company is at 4 and the chief competitor is at 5. There is no complaint regarding this voice.

The weight can be calculated for each column that represents a combination of both customers’ level of importance the strength of the relationships. This is accomplished using the product of the relationship strength and the importance. Thus, in column 1, row 1 in figure 5 the customer importance level is 3.6 and the weight for the strong relationship symbol is 9; the column weight is 28.3.

Similarly, figure 5 shows column weight for column 2 is 4.5, for column 3 is 7.4, for column 4 is 22.2, for column 5 is 61.2. These are recorded across the bottom of the matrix.

IV. CONCLUSION

To the analysis of Customers’ Requirements related to hot rolled steel the Quality Function Deployment method has been used. Product - the hot rolling steel: breadth 1000-2500mm, length 2000-12000mm, thickness 5-32 mm with grade of steel: 20 MF according to standard.

Each organization must value the importance of that measurement and in long perspective try to work out its own tools and methods of the measurement of customer’s satisfaction. However, before the organizations acquire such capital of knowledge, they have to use existing methods such as QFD (Quality Function Deployment) or CRM (Customer Relationship Management).

Elaboration and implementation of indeed effective methods of measurement of satisfaction of the customer is of huge importance, being very complicated at the same time.

Quality Functional Deployment (QFD) is a method that promotes structured product planning and development – enabling the product development team to clearly specify and evaluate the customer’s needs.

Using QFD in organizations proves their interest in quality of product, quality monitored by client. QFD is one the most powerful methods to help capture customers requirements.

V. REFERENCES