PROCEEDINGS OF THE

EIGHTH INTERNATIONAL SYMPOSIUM ON QUALITY FUNCTION DEPLOYMENT

Munich – Germany, September 4–6, 2002

QFD-Institut
QFD-Institut Deutschland (QFD-ID) e. V.

Following article was not available for publication:

Development of a Web-based QFD Tool

Yunarso Anang [i], Akio Shimizu [ii], Akihide Kitamura [ii], Daisuke Ozawa [ii], Masanobu Yoshikawa [iii], Yoshimichi Watanabe [iii], Shigeru Yamashita [iii], and Hisakazu Shindo [iii]

Abstract

Anang et al. already reported a standalone software tool for Quality Function Deployment (QFD) which provided the "Quantification Method of Type Three (QM3)" [1]. The tool was released as supplement software of the book titled "The Design Oriented Problem Solving" [2]. The tool is useful for a beginner to learn QFD and for a small sized project to develop a new product or service. However, it is natural that a new product should be developed by a large sized project that involves many persons from various divisions such as sales, design, manufacture, inspection, service, etc. In other words, a new product development system itself is said to be a distributed system. This implies that the tool of the standalone version cannot be satisfied with all the activities necessary for a new product development.

This paper reports a development of a software tool for QFD which is designed for a web-based version. The tool was developed as a database driven application in which various data used in QFD can be stored. Therefore, this tool enables members of a new product development project to work with QFD even though their sites are being distributed. We are planning to add other useful features such as QM3, Failure Mode and Effects Analysis (FMEA), multimedia data handling, and furthermore.

1 Introduction

Over 30 years have passed since QFD was first proposed by Akao [3]. During the period, QFD has been refined and applied to better quality of new products and services. In fact, we can see many applications of QFD in a variety of fields in all over the world.

In general, QFD seemingly requires a great amount of works to make one- or two-dimensional tables. This is one of difficulties to apply QFD to a specific product or service.

In order to overcome this difficulty, we can easily employ application software that support working with spreadsheet or worksheet such as Microsoft Excel, or other software tools designated for QFD. These tools surely reduce the time to make tables necessary for carrying out QFD. Even if we have to compute the weight of required quality items, the tools such as Microsoft Excel provide us with data computing. That is why most of us utilize these tools.

However, making tables cannot be all the activities of QFD since the aim of QFD is assuring quality of products or services. There must be various activities by which the quality may be got improved. Although a framework of QFD was proposed with taking cost, reliability and engineering into consideration [4], it has been so far carried out in an offline manner. Therefore, these tools are useful for a small sized project to develop a new product or service. These tools do not seem to be enough for a large sized project, because a big project involves many persons from various divisions and the sites of divisions are usually distributed in a wide area.

Recently, the progress of Information Technology (IT) gives a great influence and contribution to changes of traditional systems. For example, Supply Chain Management (SCM) has been developed on the basis of the web technologies. This makes it possible to integrate various functions necessary for a production process. Therefore, a means of quality assurance must be improved considering the growth of IT.

From the above viewpoint, we started developing a web-based QFD tool, which is designed for supporting the basic procedures to perform QFD, as well as other features. It is possible to use this web-

i. SYNC Information System, Co. Ltd., Japan.
ii. Department of Information and Electrical Eng., Graduate School of Eng., Yamanashi University Japan.
iii. Department of Computer Science and Media Technology, Yamanashi University, Japan.

based QFD tool in a product development lifecycle. This tool remains in solely processing text data. It is expected that the tool is able to process not only text but also multimedia data.

2 Development Background

Our development of QFD tool starts in 1996, beginning with the development of a standalone tool for Microsoft Windows operating system. This software tool, called QFDT, has been published for free-downloadable software from our website, and has been inquired by hundreds of people in one year. We have received feedbacks from them regarding the operability and functionality of this tool, which have been used for improving the tool. An introduction regarding the development of this tool has also been reported [1].

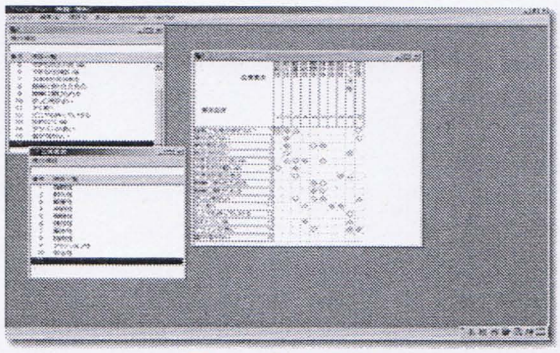

Figure 1: QFDT

QFDT includes the feature to perform all basic QFD operations, starting with creating deployment tables of required quality and quality element, and combine them in a quality chart. This tool also provides the calculation of quality planning and weight conversion. Other deployment tables such as cost, mechanism, are also available, but they are all fixed, which means they could not be customized to meet project's need. This tool also includes the feature to make a well-structured chart by performing structuralization using QM3.

To provide more flexible product's deployment and also networking functionality, we have started the new development of the enhanced QFD tool. We started this project in 1999, beginning with research for the current available QFD tools. There are over 30 of them in all over the world, but we would only focus in two of them.

The tools called QFD Capture and Decision Capture, developed by International TechnoGroup Incorporated (ITI) [5], are the major and well-known tool for QFD. These tools support the QFD process and displaying the "House of Quality". These tools are available in two versions; the Basic or Professional version for a standalone and Standard or Network version for a network environment. User needs a standalone desktop application to be installed in every client.

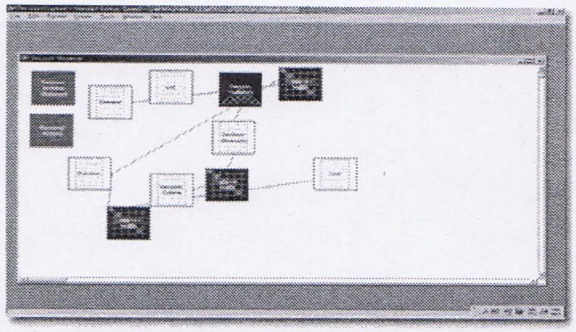

Figure 2: Decision Capture

The tool called PFT Light QFD, available as a supplement of the book published by Japanese Standard Association [6] [7]. This tool supports basic QFD operations and functions, using basic matrix method, KJ method or the affinity diagram method, and flow sheet method. Same as the previous two tools, this tool also needs a standalone desktop application to be installed in a desktop computer.

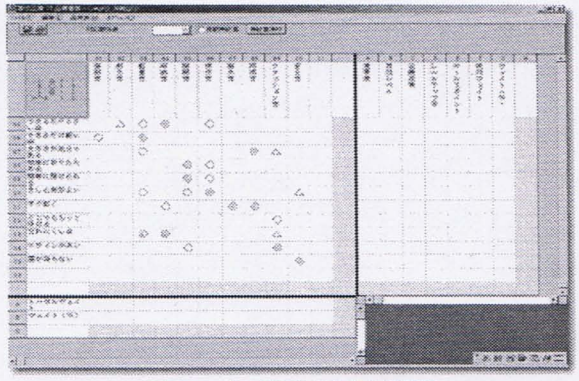

Figure 3: PFT Light QFD

Other tools that are not mentioned here, must also have supported the basic operations and functions of QFD, each with its advantages and disadvantages. What we can say about them is that most of them need a standalone desktop application to be installed. Recently, a couple of them are implementing web-based application framework.

We, here, will not discuss about the advantage and disadvantage of other tools compared with our tool. We only emphasize what the feature and benefit of our tool, and introduce a brief explanation of the technical information about our tool.

3 Requirements for Web-based QFD Tool

Requirements for the web-based QFD tool are not basically and significantly different from those required for the standalone tool. However, because of multi-persons are simultaneously using the tool, an exclusive use and transaction control of a database should be considered. In addition, because of working in a distributed environment and a broad networking system, consideration of security and privacy is also inevitable.

The response time of a web-based system is, needless to say, a common problem to give a pleasant communications between users and the tool. A web-based system is stateless. It means all information currently displayed in client side is not always the updated data. Server side also does not know where client side step is now and what is now doing. The way to "connect" client and server side is, by using state information that is stored in server and client side, and then passing this state information along with the processing action and data. That is why; web-based systems are having such as response problem because it needs a roundtrip communication to retrieve updated information. However, by minimizing the operations and data needed for processing and displaying information, the time needed for roundtrip communication between server and client side can be reduced. It means seamless operations can be performed.

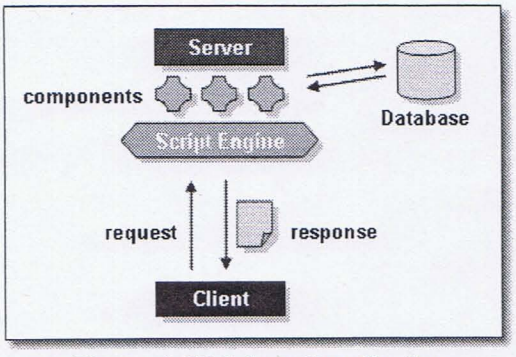

Figure 4: Web-based application

4 QFD.NET: A Web-based QFD Tool

4.1. Overview and System Specification

We have started our first experiment to develop a web-based QFD tool in 2000. We, first, design and develop a database structure to define tables, charts, and also project management in QFD. Our goals are: To provide flexible tables and charts creation and also multi-persons project management.

In the first experiment, we introduced a relational database management system (RDBMS), a programmable web server, and a server component enabling utilization of deployment hierarchies. We use Microsoft server applications, SQL Server for RDBMS, Internet Information Service for web server, and we also use server component to utilize hierarchical information in a web page.

After doing several experiments and prototyping, finally we develop a web-based tool called "QFD.NET" as its development code name. This tool is still under development and we seek for enhancement and optimization.

4.2. Database Structure and System Design

4.2.1. QFD Tables and Charts

To implement tables and charts in RDBMS, we break tables and charts in QFD; standardize the information among them, and store them in 4 tables (in RDBMS not in QFD).

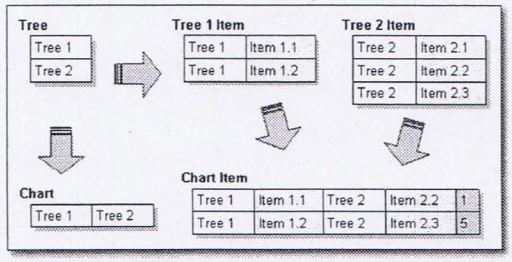

Figure 5: QFD tables' breaking apart (former)

The Tree table stores the information of deployment tables in QFD. Hierarchical information of items in deployment table is also stored in this table. The table of Tree Item stores the items contained in a deployment table. The Chart stores the combination of two deployment tables which defining a chart in QFD such as a quality chart. And the table of Chart Item stores the relations among items within a chart.

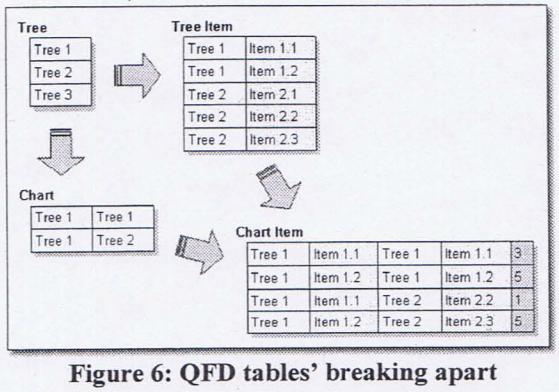

Figure 6: QFD tables' breaking apart

Formerly, every deployment table in QFD was designed to have the same structure. It means, every time new deployment table is created, the new 3 tables must be created on-the-fly. And every time new chart is created, new table must also be created on-the-fly. Though RDBMS provides a new table creation on-the-fly, it is not well-optimized for a big project and multi-user environment regarding its performance. We solved this problem by fully applying the features of relational database; break all the deployment tables apart and make relations among them.

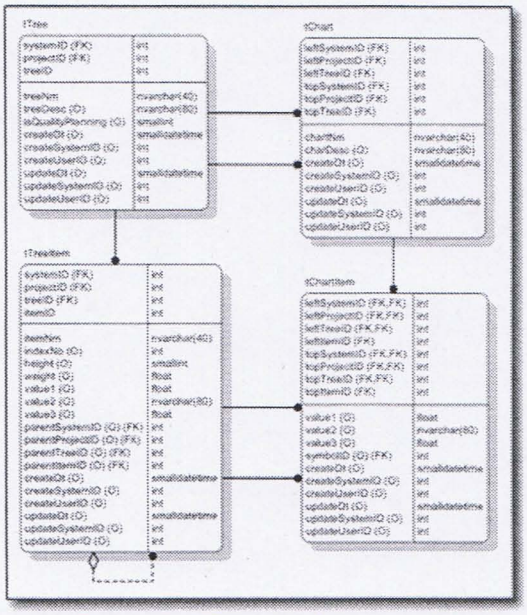

Figure 7: QFD tables' data model

Beside those four RDBMS tables, we also define other tables needed to store information about project management as well as user management that will be described in the next section.

4.2.2. Account Management

We implement project and user management by defining the following units: user, group, and project. They are independent of each other.

- User is the smallest unit in project and user management. To work and use this tool, a user account must be created.
- Group is used to define multiple users who can work and have the same permission. User can be included in more than one group.
- Project is used to define a QFD tasks. Multiple deployment tables, charts, and quality planning can be created in each of this project.

After defining and creating all of these units, then we can assign their permission for working with a particular project. Assignment of project can be made to a particular user or group.

In addition to these units, there is also a group called role, which define the permission of user or group to administrate the system.

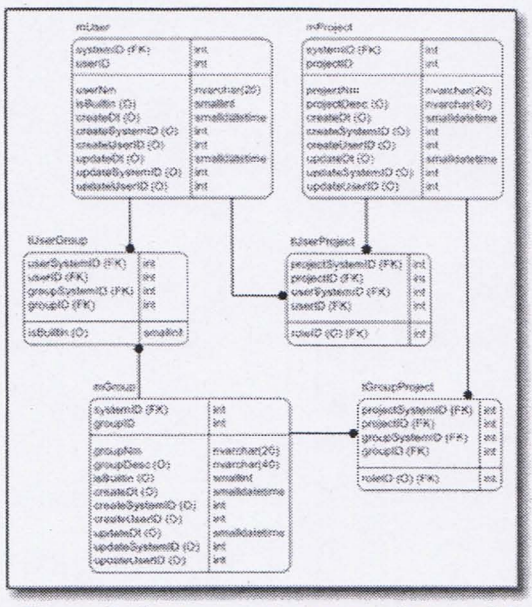

Figure 8: Account management data model

4.2.3. System Management

Lastly, we implement a global management system to manage users, groups, and projects working in the same domain, e.g. department, branch, or even company. This will enable the implementation of an enterprise scale of system.

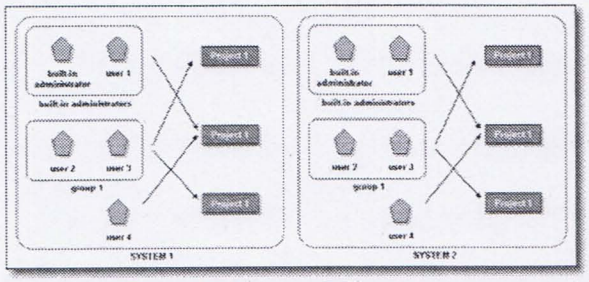

Figure 9: System Management

4.3. Web-based Application

4.3.1. Basic Operations

Basic operations in "QFD.NET" include the administrative operations and main operations regarding the role or membership of logged user.

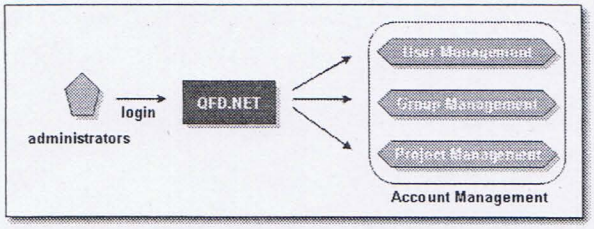

Figure 10: Administrative Operations

Administrative operations are allowed to administrator (built-in administrator user) and other users who are members of administrators (built-in administrators group). Administrators create users, necessary groups, and projects. Then, assignment of users or groups to the projects can be made to permit a particular user or group to manage a particular project. Member of a particular group that is assigned to a project also has permission to manage the project.

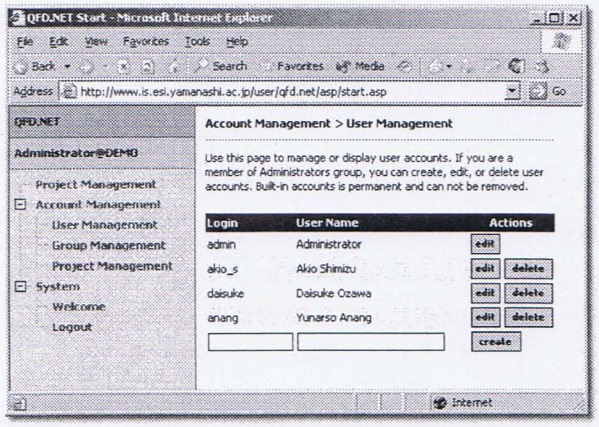

Figure 11: User management

Figure 11 shows how the users account is managed. Built-in administrator or users who are members of built-in administrators group are allowed to manage users account.

After all necessary users, groups, and projects are created and assigned, then the user can login and manage the assigned project.

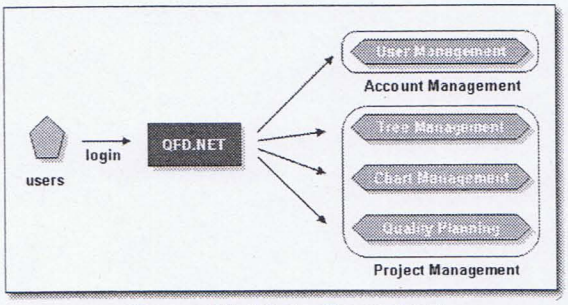

Figure 12: Main Operations

Every user is permitted to modify his/her account information, including name and login password. User who is allowed to manage project, can open the project, and then make a necessary work within the project. It includes deployment table (tree) management, chart management, and quality planning.

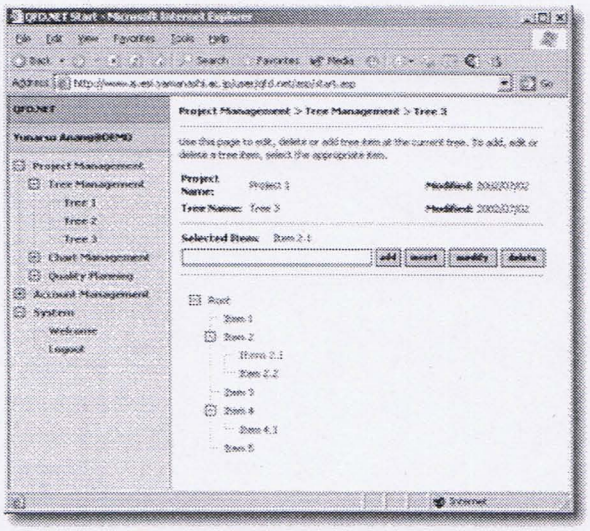

Figure 13: Tree management

Figure 13 shows how the deployment table managed. Items within a deployment table could be created in a hierarchical model.

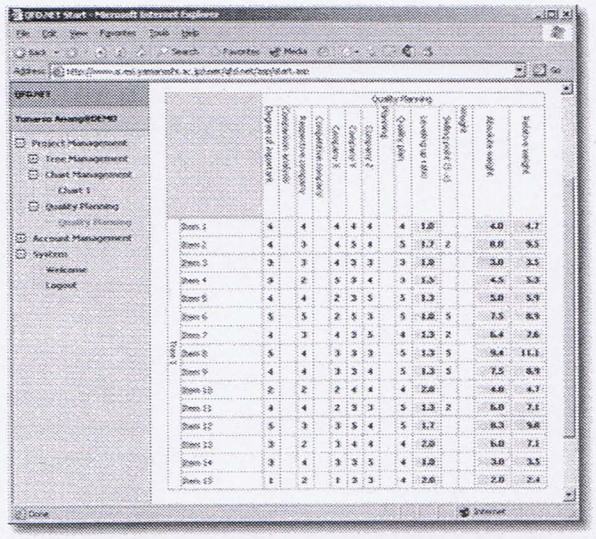

Figure 14: Quality planning

Figure 14 shows how to perform a quality planning. Degree of important, comparison analysis, quality plan, and selling point are items should be entered. In change of these items, leveling up ratio and weight will be automatically calculated seamlessly.

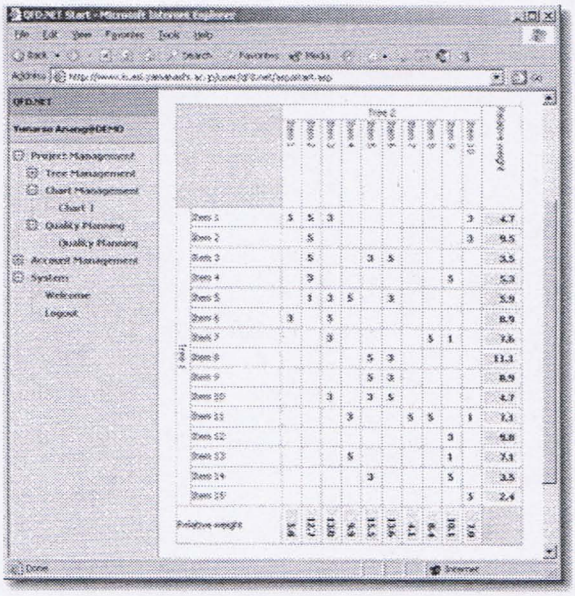

Figure 15: Chart management

Figure 15 shows how to create and define a chart such as quality chart. Weights that are derived from quality planning can be utilized to calculate the other deployment table.

5 Future Development and Subjects

As described above, this web-based QFD tool will provide a flexible QFD work through the enterprise need with scalable and easy to manage environment. However, yet, there are still several subjects that should be considered and implemented.

- Every deployment table currently could be created for having a hierarchical structure. However, the relations among two deployment tables currently could not consider the hierarchical distributed value. This also effected in quality planning. This feature should be considered and implemented.

- In the former standalone QFD tool, we have implemented a structuralization method using QM3 which is useful to optimize and create a well-structured chart. This feature also needs to be implemented for an add-on feature.

- FMEA and other features that will be useful to help and enhance QFD work will also be considered.

6 Conclusion

QFD is known as a significant method to perform a product development and to assure its quality. However, the actual works performed in the actual world are less to know. Since every new product development always considers a competitive factor, this information is almost concealed. It is natural, to provide a useful QFD tool that needs user's requirement, feedback from user, who a person is working in product development using QFD, is indispensable.

We are planning to publish this tool to gather information and evaluation from people who are working in QFD or product development. We will continue our research, gather information, and develop.

Disclaimer

Trademarked names may appear in this paper. Rather than use a trademark symbol with every occurrence of a trademarked name, we use the names only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

References

[1] Y. Anang et al. A Software Tool for Quality Function Deployment Incorporating the Quantification Method of Type 3. World Innovation Strategy Conference – Proceeding of International Symposium on Quality Function Deployment (1998, Sydney). Pp. 77-84. 1998.

[2] H. Shindo ed. The Design Oriented Problem Solving. JUSE Press. 2002. in Japanese.

[3] Y. Akao ed. Quality Function Deployment. Productivity Press. Cambridge MA. 1990.

[4] Y. Akao e al. Quality Deployment Method – A Total Deployment Including Cost, Reliability and Engineering. JUSE Press. Pp. 71-82. 1990.

[5] International TechnoGroup Incorporated website. http://www.iti-oh.com/.

[6] M. Ofuji et al. QFD Guide Book. Japanese Standard Association. 1997. in Japanese.

[7] Japanese Standard Association website. http://www.jsa.or.jp/default_english.asp.