Fujitsu's Activities for Quality Assurance

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(Manuscript received July 10, 2007)

Fujitsu's basic policy is to use advanced technologies for providing products and services that offer quality superior to those of our competitors. Fujitsu's quality assurance is characterized by activities of the Quality Assurance Group that controls the quality of individual products by using information shared among related divisions. We take various actions in providing our customers with high-quality products and services on a continuous basis through direct support. For example, we have ensured high product reliability in social infrastructure systems and mass-produced consumer products, increased the number of purchased components, improved product development and production processes (such as by entrusting plants to affiliated companies), secured stable system operation at customer sites, and ensured compliance with laws governing quality. We have also made continuous environmental improvements and regularly reviewed our quality assurance processes. This paper describes how Fujitsu achieves its high level of quality from the stages of development and design, to the stages of manufacturing, testing, and maintenance.

1. Introduction

Fujitsu prescribes "The FUJITSU Way"[1),note)] as its action guide for all employees to instill a sense of value common to all Fujitsu Group companies, and defines its mission, values, and code of conduct. To guide all employees in performing tasks by always considering quality, the quality policy under The FUJITSU Way declares: "We aim to earn our customers' trust in Fujitsu" (**Figure 1**).

The issue of "quality" is only now attracting worldwide attention. Fujitsu's history of quality improvement activities, however, dates back to 1952 when a production standard known as the "Fabrikation Vorschrift (FV) Standard" was established. We initially adopted the concept of quality from Siemens AG of Germany, a business partner at that time. We then modified that concept in Fujitsu's own style for introducing quality control.

From about 1965, computers and telecommunications equipment have been utilized in support of social systems, and consequently higher reliability has been requested of all Fujitsu products including individual parts. In such an environment, Fujitsu launched its "High Reliability Program" as company-wide movement in 1966. Regarding this program, Kanjiro Okada (Fujitsu's fifth president) declared, "Quality precedes everything". He also wrote in Japanese ink on a large square writing card: "Quality speaks for itself — no matter where you go". This marked a turning point in Fujitsu's concept of quality, and later formed the basis of Fujitsu's quality improvement activities.

note) The FUJITSU Way has been fully revised and updated for "FUJITSU Way" since April 1, 2008.

The inspection division was mainly responsible for the conventional quality assurance of each product, based on the concept of "detecting faults". This concept later evolved into "production without making faults" and "quality assurance in upstream stages".

In line with the changing trends in quality assurance, the quality assurance function common to the divisions responsible for respective products was unified in 1995. This unification resulted in a defined mission: "Considering the customer's viewpoint and management's viewpoint, and providing services more advantageous under systematic, centralized conditions than when provided separately by individual divisions". To assure the quality of respective products across the related divisions, the person in charge of quality assurance for each product in a given division should also serve concurrently as a member of the Quality Assurance Unit. This unit monitors quality data in a timely manner, handles complaints made by customers, and thus serves as an organization for collectively managing all data related to quality. The Quality Assurance Unit meets once a month to share quality information and technical knowledge from the respective divisions. The related divisions are immediately notified of any serious product failure detected at a customer's site, with related models being promptly corrected or modified. This monthly meeting has been continued since 1995, and held a total of 137 times (as of July 2007).

2. Quality assurance system from design to shipment

The other mission of systematic quality assurance activities is "creating a quality assurance mechanism for reforming corporate culture". This mission is undertaken to standardize the common concept of quality in various stages covering design, manufacturing, testing, shipment, and the handling of complaints. This mission also ensures that the divisions responsible for respective products conform to quality standards, and prevents these divisions from deviating from Fujitsu's concept of quality assurance. The main quality standards are described below.

2.1 Development judgment

Before initiating the development of a new product, all related divisions including the

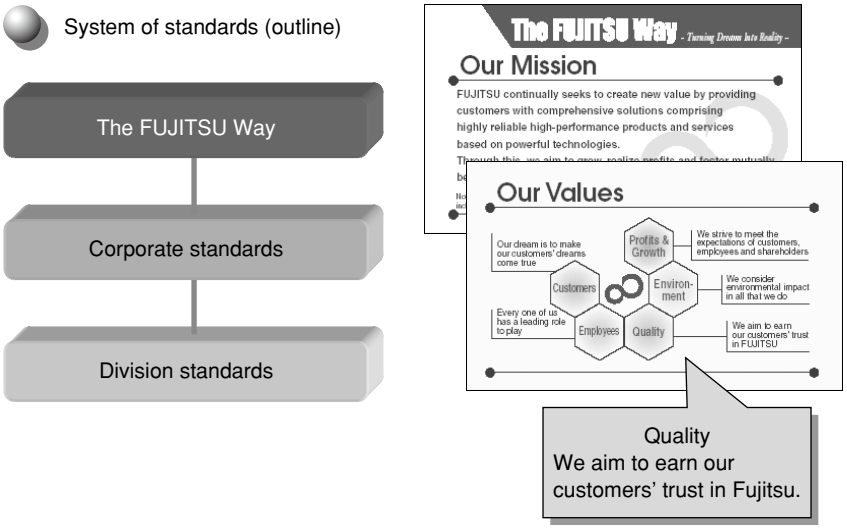

Figure 1
Quality policy of Fujitsu.

business division, marketing division, and quality assurance division check the validity of starting development. Specifically, these divisions confirm that customer needs are satisfied under the planned development policy, by the development organization, and through the development processes, product overview, and technologies being employed. The divisions also check whether the product to be developed can be used for a long time. If the divisions decide that development is valid, the process proceeds to the design review step (**Figure 2**). Conversely, if they decide that development is not valid, the development plan is reviewed.

2.2 Design review and design verification test (DVT)

To acquire the specified design quality, as well as implement the proposed development plan and design, the contents and processes of new technology, design, production, testing, transport, installation, and maintenance are objectively evaluated based on the knowledge of related divisions. Current conditions are checked to determine whether the development plan is valid, and any problems detected are solved so that the development process can proceed to the next step. Thus, the validity of product development and applying the basic technology for satisfying customer and market needs are evaluated to acquire the product quality required, in compliance with the first customer shipment (FCS) conditions of the product. The design review is conduced in steps DR0 to DR4 shown in Figure 2. In step DR2 after the basic design, the Reliability, Availability, Serviceability, Integrity, Security (RASIS) check is made to confirm the rate of product operation at the customer's site, and the engineering division conducts DVT. This test checks whether the product satisfies the design specifications, standards, and drawings, and whether the design is correct and valid. In step DR4, a result examination meeting is held to check the status of quality at the customer's site three months after shipment, and handle and solve any problems relative to developing the

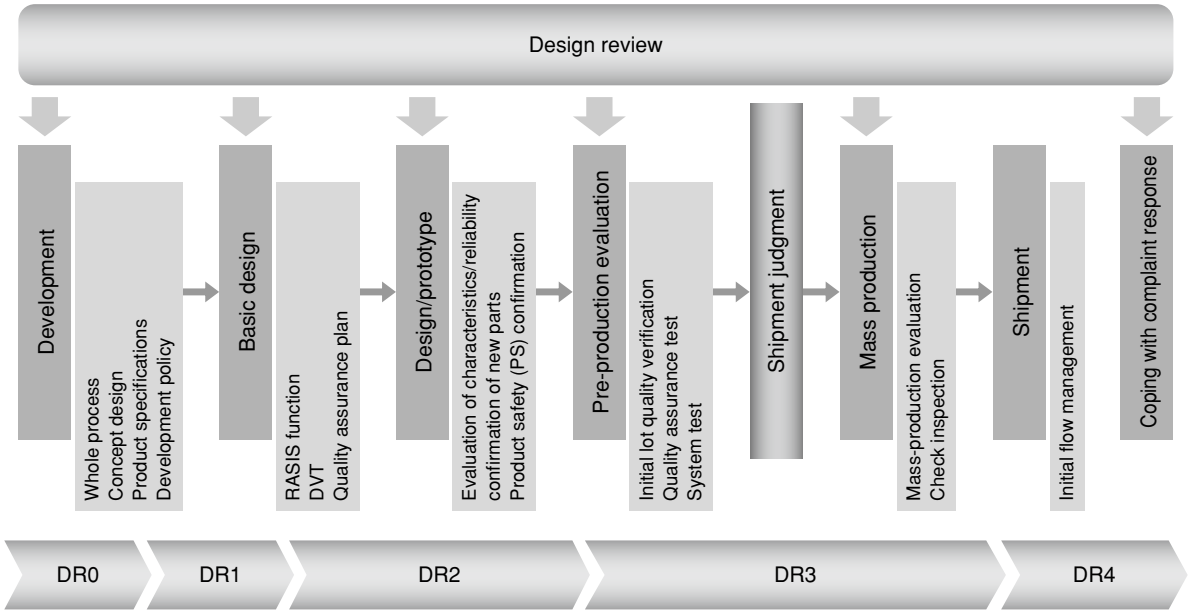

Figure 2
Standard for design review.

next model.

2.3 Quality assurance by leading suppliers

Since Fujitsu purchases the bulk of its main components from external suppliers, assuring the quality of those purchased components is essential. Fujitsu primarily purchases standard parts, units, and products that are used worldwide. Efforts in leading the suppliers have been enhanced to ensure the stable purchase of quality components. Fujitsu's quality requests for these components are satisfied based on purchase specifications, evaluations of reliability, factory inspections and audits (of quality and environmental conditions), and Quality Assurance Agreements (QAAs). The purchased components are checked with regard to six items: quality, delivery date, environment, price, technology, and handling of information security. The check results are released in the form of a Supplier Performance Review (SPR) so that the volumes ordered can be adjusted on a quarterly basis.

Members of the Supplier Quality Engineering (SQE) division visit the factories of suppliers to confirm the quality of the most important components to be purchased.

2.4 Initial lot quality verification and product safety (PS) confirmation

Actual prototypes are used to satisfy the product quality needs of customers, with appearance, usability, and ease of replacement from the customer's viewpoint being checked. Any detected problems to be solved are reported to the engineering division, which then improves or corrects the problems. At the same time, PS check sheets are used for assuring customer safety in order to prevent problems associated with the Product Liability (PL) Law from occurring.

2.5 Manufacturing review (MR) and judgment for starting evaluation phase

In parallel with the design review described above, the design and development divisions, in cooperation with the production engineering and production divisions of the factory, conduct activities for improving productivity and testability in the production process. These divisions also conduct activities for preventing quality problems from occurring, and thus ensure an early start of mass production and the production of products at low cost. These activities entail an examination of the facilities, production method, and auxiliary materials, with the examination results passed to the quality assurance division for product evaluation. The design, development, and quality assurance divisions then hold a meeting for judging whether to start the evaluation phase where products must pass the quality assurance test.

2.6 Quality assurance test

The products approved at the meeting for judging whether to start the evaluation phase are subject to a quality assurance test conducted by the quality assurance division. This test consists of 86 sub-tests for confirming product performance, function, reliability, safety, and design validity by considering the installation environment and related margins. Any product failing to pass all these sub-tests cannot be shipped, and the problems detected must be solved. In the temperature or voltage margin test, the most severe conditions that a product can withstand are measured to determine the product's weak points relative to accommodating various installation environments of customers. Moreover, the system performance of other hardware/software products that may be combined with products tested as described above is evaluated to confirm system quality by considering stable operation at the customer's site.

2.7 Decision Conference for Product Shipment

After products pass the checkpoints above through the Development-Project Examination

Committee, design review, initial lot quality verification, MR, and quality assurance test, the Decision Conference for Product Shipment finally checks whether the products can be supplied to customers. At this conference, the related divisions check the results of 25 examination items that include legal compliance and safety, beginning with the development stage. Should any item fail to pass the judgment, the conference prohibits shipment of the product concerned.

2.8 Mass-production check

Mass production may begin upon the approval of product shipment. Components purchased daily are subject to acceptance inspection, printed circuit board (PCB) units are tested, and product shipment inspection is conducted. In addition to ordinary shipment inspection, Fujitsu conducts an audit inspection by periodically sampling products, in order to periodically confirm the stability of the important quality characteristics. Fujitsu also conducts the On-Going Reliability Test (ORT) to continuously check the reliability of mass-produced products for the early detection of aging-related problems. Any faults detected in these tests are immediately fed back to the design stage, and the mass-produced products are then modified and corrected. Based on its manufacturing philosophy, Fujitsu targets the goals of "supplying customer-requested, top-quality products" and "manufacturing for high profit". This is why Fujitsu conducts audits to ensure that the determined work and tests are steadily conducted in the mass production process, and corrects any problems detected in an audit. A wide range of activities concerning quality, safety, and environment are covered by these audits in order to produce products that customers can easily and reliably use.

3. Quality evaluation index

A quality evaluation index is assigned to each product shipped after the development, production, and test processes. This index is used to monitor field quality for making further quality improvements.

3.1 Setting quality evaluation index

The Annual Failure Rate (AFR) is set as a field quality target (meaning the highest quality in the industry) of each product in order to improve quality. AFR is assigned to each product, with a statistical method used to monitor quality. The monitored results are arranged as quality information to be reported at a conference attended by management officials. The items of improvement are then reported to the related divisions for making further quality improvements.

3.2 Investigation of customer satisfaction with products

Fujitsu entrusts a third-party organization to conduct an independent investigation of customer satisfaction with given products. This investigation includes a comparative check of product quality and customer satisfaction relative to competitive products. Based on the investigation results, Fujitsu sets a quality target for each product to exceed that of competitive products, continues making daily quality improvements, and takes concrete measures for improving customer satisfaction (**Figure 3**).

4. Product risk management

Fujitsu's overall brand image may be adversely affected by any serious product quality problem. To prevent such a situation, all employees are made to understand and thoroughly utilize the concept of risk management.

4.1 Escalation of quality information

Information on serious failures or complaints about a customer's system or product is reported to the Head-Office Risk Management Committee for promptly collecting and sharing such failure information. This information is also

reported to all levels of management, and under the prescribed code of conduct so that complaints are never ignored. Information about all detected failures is stored as digital data in the quality information system, and shared for product risk management.

4.2 Maintaining compliance

To comply with applicable laws and industry standards (e.g., PL law, Electrical Appliance and Material Safety Law, Consumer Products Safety Law, regulations prohibiting the inclusion of hazardous substances and chemicals, and regulations to prevent security vulnerability) governing Fujitsu products, law-abiding activities must be conducted from the start of product development. In addition, Fujitsu establishes standards for judging product shipment and the handling of complaints and also audits and corrects the organized quality assurance activities of the divisions responsible for respective products (**Figure 4**).

5. Sharing quality-related information

Reporting a huge amount of quality information in a timely and correct manner is one of our important quality assurance activities. Fujitsu created the Quality Knowledge (QK) portal site to disclose quality information. This site is divided into two sections: a section for the sales/SE/CE divisions and a section for the business division. The sales division can acquire quality information about Fujitsu products from the site for use in such activities as technical consultation and customer handling specific to an IT company. Anyone requiring quality information can promptly acquire it from the site. In this way, both the unification and sharing of information are realized at the same time (**Figure 5**).

To obtain the status of quality at a customer's site, maintenance and incident information is statistically analyzed by the Total Analysis System of Quality (TASQ), and then used in activities to improve customer satisfaction.

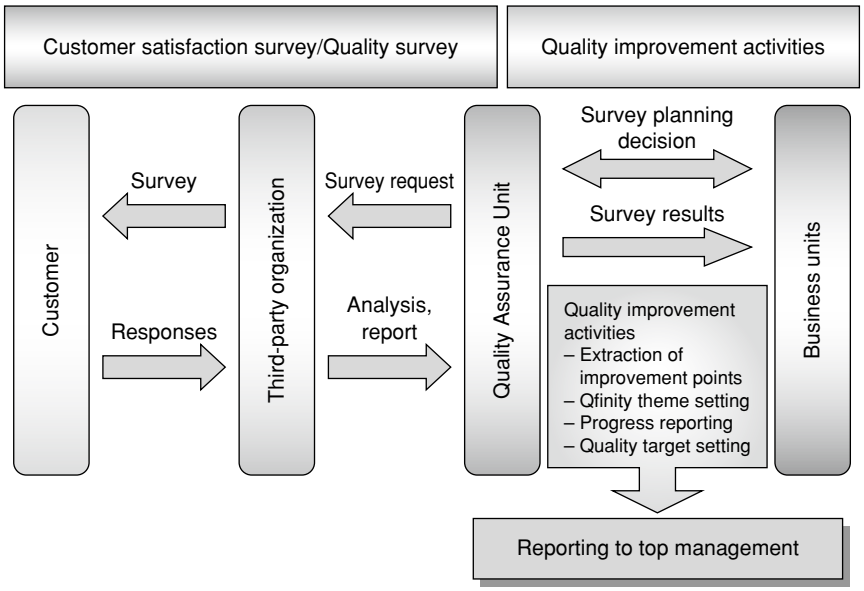

Figure 3
Quality position of Fujitsu products in industry.

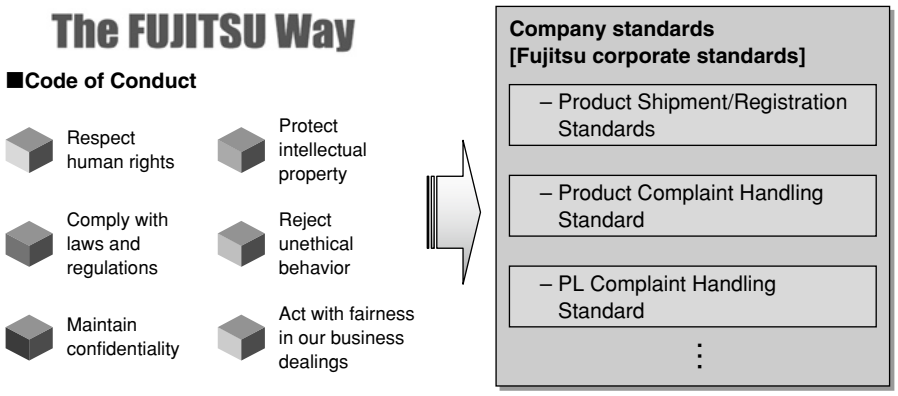

Figure 4
Product risk management.

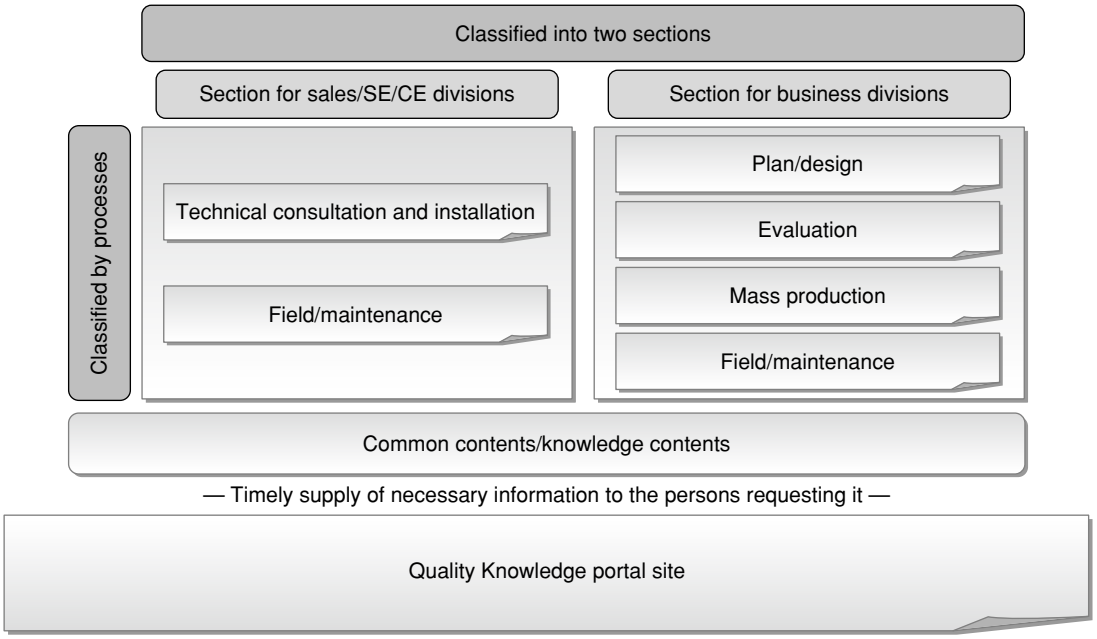

Figure 5
Disclosure of information related to quality.

6. Problems and solutions regarding quality improvements

The previous sections described Fujitsu's organizational mechanisms from product development to the handling of complaints. Fujitsu also faces certain problems regarding quality improvements. The following subsections introduce some important, common problems.

6.1 Handling regulations prohibiting inclusion of hazardous substances and chemicals (RoHS directive, J-Moss standard, and China's RoHS directive)

In a broad sense, we consider "environment" as an issue of quality. Even if there are no visual problems in function or performance, our company's image may be immediately impacted in a negative manner if any material it uses violates an environmental law or regulation. To avoid such a quality risk, the use of any prohibited hazardous substance or chemical must be prevented.

6.2 System evaluation of purchased components

Compared with conditions 10 years ago, the sales percentage of proprietary products (conforming to Fujitsu's independent specifications) has decreased, while that of open products (conforming to global standards) has increased, thereby reversing the previous balance. Consequently, the volume of Fujitsu-purchased components made by manufacturers other than Fujitsu has increased remarkably. Since such non-Fujitsu components are included in many Fujitsu products, the range of Fujitsu's quality assurance must be further clarified. The test services for products containing non-Fujitsu components must also be enhanced in the future.

6.3 Improving system quality

The abilities and skills of SEs are important in constructing high-quality systems that satisfy customers. One relatively new action for quality assurance that we launched in October 2004 is promoting the visualization of system quality by enhancing cooperation with the SE division.

7. Quality education

Maintaining a confidential relationship with customers into the future requires that respective employees be fully aware of the enhanced concept of quality and make concrete technical improvements through the previously described quality assurance system. For this purpose, Fujitsu holds many courses on quality and reliability engineering education to improve the abilities of its employees. The education division plays a leading role in this education. These courses range from an illuminating course about quality to more practical courses on data analysis and related subjects using statistical techniques. Product quality will thus be further improved through these training courses.

8. Company-wide quality improvement activities

The High Reliability Program described in Introduction has helped improve product quality for a long time, but recently has been implemented primarily in factories only. Moreover, the level of improvement activities has decreased in the design and development, and staff divisions. To address this problem, a new company-wide program — the Infinite Quality (Qfinity) program — was launched in April in 2001.

8.1 Qfinity program

The Qfinity program includes project activities for solving the major problems in each division and activities for solving daily problems at each work site. The latter activities include "small group activities" as a project, and "reforming and improvement proposal activities". For details of the Qfinity program, see "Fujitsu's Quality Improvement Model: Qfinity" elsewhere

in this issue of *FUJITSU Sci. Tech. J*.

8.2 Characteristics of Fujitsu's quality improvements

Fujitsu's quality improvements are characterized by the targets (problems) determined by all divisions, including the Staff division, and the continuous pursuit of the PDCA cycle through Qfinity. The determination of targets is characterized by the following: "What is a problem? Grasp the truth by confirming three actualities: the actual location of a trouble, actual objects at that location, and actual happenings at that location".

9. Conclusion

It has been 12 years since the function for handling the quality assurance of each product among the related divisions was initiated. Product quality has been improved remarkably over these past years. Moreover, questionnaires to customers collected by a third-party organization show that the level of Fujitsu's quality exceeds that of competitors. Conversely, the level of customer satisfaction regarding certain Fujitsu products fails to match that of competitive products. This reveals that customer satisfaction is one of the true quality indexes cannot be fully acquired. To address this problem, we must assign all services to Fujitsu-specific quality improvement activities (via the Qfinity program), and enhance our quality improvements for the sake of customers.

In the future, Fujitsu intends to continue improving quality by fully applying the technical knowledge acquired through quality improvement activities to various products and services. In this way, we will continue to supply products that customers can easily and reliably use.

Reference

1) Fujitsu: Our Corporate Philosophy — FUJITSU Way.
http://www.fujitsu.com/global/about/profile/philosophy/

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