

# 國立中央大學八十八學年度碩士班研究生入學試題卷

所別： 工業管理研究所 丙組 科目： 個案評述 共 2 頁 第 1 頁

Digicomp Computer Corporation designs, assembles, and sells a variety of personal computers. Although its prices are competitive, Digicomp competes primarily by assembling and shipping within 48 hours computers that are customized to customers' specifications. Almost all components for the computers, from the chips, boards, and disk drives to the cases and keyboards, are purchased from vendors. In the early 1990s, feverish price competition within the industry made it crucial for Digicomp not only to reduce its operating costs but also to distinguish itself in terms of product quality. The CEO of Digicomp decided to perform a strategic reevaluation of the company, especially of its quality management system.

## Evaluating Current Performance

The first two phases of this evaluation involved (1) meeting with customers to determine their perceptions of Digicomp's quality and getting customers' input on what quality dimensions needed attention, and (2) performing a quality cost audit of Digicomp to identify the primary sources and magnitudes of quality costs.

### Customer Assessments

Digicomp formed two three-person teams to meet with randomly selected customers and potential customers of Digicomp. Each team included one representative from the marketing/sales division, the manufacturing division, and the product design group. After meeting with nearly 500 customers, the teams were able to agree on several common themes they were hearing:

1. Digicomp handled complaints quickly and courteously, frequently replacing computers at no charge. But the frequency of complaints was too large, with over 20% of customers reporting some quality problem within the first year of ownership.
2. Customers perceived most of the quality defects as being due to carelessness or poor assembly, such as installing the wrong disk drives or putting them in the wrong slots, or forgetting to install a modem, rather than component failure.
3. Purchasers of Digicomp's laptop computers were pleased with the performance, but they felt that the computers were too heavy and big and that recharging the battery took too long.
4. Although Digicomp was good at customizing well-established computer technology, it was often behind its competitors in introducing and making available state-of-the-art technology.

### Quality Cost Audit

A team of three people, one each from marketing, manufacturing, and quality control, performed a quality cost audit. The audit took over a month to complete because most of the data had to be gathered from basic production or personnel reports or special studies. The quality costs were estimated at \$6,335,000 per year, which was equivalent to 11.5% of the division's annual sales of \$55 million and more than its profits of \$5 million. With such a large amount spent on quality, one would expect fewer quality problems than those reported by the customers. But the general problem is apparent from the cost distribution: costs of over \$4.9 million were incurred due to failures (making defective products), and only 9% of the quality costs were devoted to prevention.

As the audit team studied some primary production and material management documents, they identified the main causes of quality defects. The customers' perceptions were generally correct: most defects were due to assembly errors at Digicomp facilities. However, the audit team also found some quality problems with the hard disks, disk drives, and cases.

## Revising the System

After reviewing the reports on the customer assessments and the quality cost audit, the CEO met with the division vice-presidents and group directors. They decided that an organization-wide effort was necessary to make Digicomp a recognized quality leader. They also felt that some major improvements could be made quickly, and that a long-term quality program could be introduced within six months of the time the initial steps were taken. Revision of the quality management system was to concentrate initially on three areas:

### (1) Product Design

Digicomp's product design group does not design computers from scratch. Its primary job is to decide which standard components to include as options for customized computers. Because the designers saw their job primarily as one of selecting from among available options, they never consulted customers directly for their preferences.

After a meeting to discuss the results of the customer assessments, the design group decided to consult customers regularly on a formal basis. They agreed to develop a *Quality Function Deployment* (QFD) relationship matrix for each product line and revise it every six months.

From the very beginning, use of the QFD relationship matrix was successful. First, customers were pleased to be asked for their opinions, and non-customers were impressed with Digicomp's efforts; many of them said that they would consider Digicomp's products more carefully in the future. Second, the results led the design group to revise several of their products. For example, they made the laptop computer smaller so that it could fit in a briefcase and still leave room for papers and files. Third, the competitive benchmarking awakened the design group to the fact that their products were not as competitive as they had thought. This led to the idea of using multidisciplinary teams consisting of representatives from marketing/sales, manufacturing, and purchasing to review all new and existing products quarterly.

### (2) Process Design and Operations

1. The vice president of manufacturing was shocked at the magnitude of quality costs. He quickly organized a task force to investigate their causes. Special teams were formed to address each of these problem areas.

1. *Misinstallation of Components.* The team found that there were three distinct types of misinstallation. The first was installing the correct part incorrectly. Several components were symmetrical, so it was easy to have a chip facing the wrong direction or installed upside down. The manufacturing team met with the designers and arranged to have some components redesigned; for example, one chip supplier suggested that the top of some components be marked in red. Other components were redesigned to have notches so that they could be installed only in the correct way. The second misinstallation was installing the correct part in the wrong location. The most common situation involved two disc drives of different sizes (3.5 and 5.25 inches). Some customers wanted the smaller drive on the bottom rather than on the top. The team determined that a large part of the problem was that special customer requests were not highlighted on the production documents. The system was changed so that work orders with components requested in special locations had a colored sticker attached to them to get the workers' attention. The final misinstallation problem was installing the wrong components such as the wrong disc drive. Many components looked almost identical, so it was easy for them to get mixed up. Digicomp's solution was a complete revision of the assembly process. Because of the customized assembly, each computer was assembled by one person (in contrast to using a repetitive flow process if all the computers were essentially identical). In the original process at each work bench, a supply of the

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most common components was maintained; if the assembler needed any special components, he would go to the material storeroom and get them. Frequently the assembler would not notice a request for a less common version or would accidentally use the wrong component. In addition to the assembly errors, each work area looked sloppy and required considerable extra space for storage and maneuvering.

Digicomp decided to stop storing components at each work bench, except for the computer cases and hard drives. Instead, two people were assigned to work with customer service representatives preparing assembly kits for each computer ordered. As soon as an order was received, the order form was handed to one of the kit preparers, who would gather all of the components from the material storeroom (which was adjacent to the kit preparation area) and put them into a kit box, with a copy of the order form attached to it. Every few hours the kit boxes would be taken to the assembly area and distributed to the assemblers. Because the assemblers did not have to gather components, which disrupted their work, their efficiency increased and the number of installation errors dropped to almost zero. In addition, work benches were reorganized so that there was one storage area for cases and hard drives for every four work benches and several hundred square feet of work space were freed up for other uses.

2. *Missing Components.* The use of kits essentially eliminated the problem of missing components. Kit preparers checked off parts on the order form as they were put in the kit, and the assembler installed every component in the kit; a component left in the kit would be obvious (a form of *poka yoke*).

3. *Hard Drive and Disk Drive Failures.* The team found that there was little it could do alone to eliminate defective hard drives and disc drives. This was something that the company had to work on with the suppliers of these components. However, in the short term, the team did change the testing procedure so that simple tests of the drives, which could identify some of the defects, were performed immediately before installation. If a drive had an identifiable defect, it was not installed.

4. *Cracked Computer Cases.* Digicomp identified three causes of cracked computer cases. The first was the design of the cases. The cases were designed to have uniform strength in all directions. However, most impacts (e.g., dropping) occurred at corners, so Digicomp redesigned the cases with reinforced corners. Second, Digicomp bought its cases from three suppliers. It found that cases from one of the suppliers failed at a rate five times that of the other two. Digicomp informed the supplier of this fact. Digicomp agreed to work with the supplier to solve the problem, but if quality did not improve to equal that of the other two suppliers, Digicomp would stop buying from it. Third, some of the cracked cases were due to assemblers dropping and bumping the computers as they removed them from the work tables and loaded them for transport to the packaging department. These problems were reduced by using padded transport carts. If the computer was dropped on the cart there was less concentrated impact.

(3) *Relations with Suppliers.* Digicomp made a concerted effort to work more closely with suppliers in three ways. First, anytime a supplier-related defect was identified, the vendor was contacted and a meeting with its representatives was held to find a solution. The immediate problems involved improving the reliability of the hard drives and disk drives and the durability of the cases from one supplier. Second, suppliers were helpful in finding ways to reduce assembly errors (e.g., painting the tops of components or notching components to reduce the chance of misinstallation). Third, vendors were involved in the product design process on an ongoing basis. The purposes were to improve the design of the computers by using more common and standard components and to incorporate the newest technologies into Digicomp's computers more quickly.

## Question (Answer in Chinese):

- (80 points) Refer to Figure 1, how would you relate the described case to the concept of "Concurrent Design of Products and Process"?
- (20 points) What outcome would you expect after Digicomp Computer Corporation revised its system?

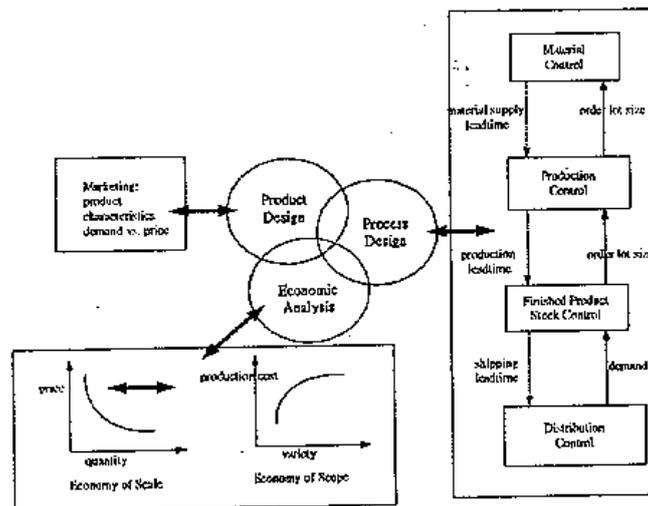


Figure 1