QUALITY COST AND QUALITY ECONOMICS IN SERVICE ORGANIZATION

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INTRODUCTION

Genichi Taguchi was the first to define Quality as "the loss a product causes to society" [1], thus creating a bridge between Quality and losses, i.e. quality related Costs.

The traditional approach to Quality costs necessitates expansion of the organizational accounting system to include the costs of Quality maintenance such as prevention, detection and correction of defects.

This approach is based on the premise that "money is the basic language that upper management understands" [2].

Both manufacturing and service industry [3] summarize these costs into three categories:

1. Prevention - The Cost of minimizing the chance for future failures and mistakes.
2. Appraisal - The Cost of the determining whether or not a manufacturing process and its product meet the specified requirements.
3. Failure - The Cost of repairing defects that appeared or were detected prior to the transfer of the product to the customer (internal failure cost) or those defects which were detected after the product was delivered (external failure cost).

Usually the management is aware of actual expenses of prevention, appraisal, repairs and corrective actions, and even downgrade of a product as a result of errors, faults and improper treatment. But management does not consider additional and sometimes heavy intangible losses such as those mistakes that give the supplier a poor reputation resulting in loss of customers.

These intangible losses are very important to service organizations such as transportation, hotels, communication services, post office services, repair shops, educational facilities, banking and others, which depend on continuous and wide contact with their clients. When the customer is not satisfied by the requested service he will most likely not contact the same supplier again, particularly if there are others around, which is usually the case.

THE MODEL

The conservative three-type quality costs model mentioned above is mixing two essentially different types of money:

1) The conscious investment (prevention & appraisal costs) as input set-up Control Parameters to the system for achievements of desired results.
2) The payments and losses required to correct unpredicted failures and eliminate unexpected problems and troubles as an output, result, Response from the functioning system.

Fig. 1 describes a proposed model which combines Quality Costs and Qualimetry [4]. This model should be applied when there are many different factors affecting the

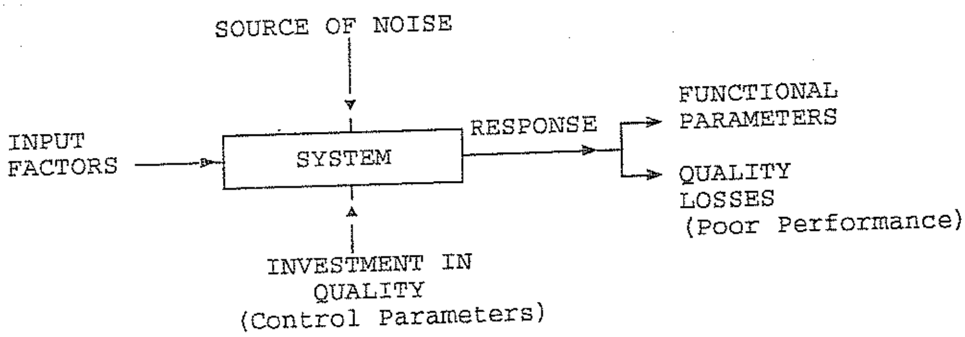

Figure 1. The "Black - Box" Cost-Effectiveness Model

performance of the service system or when the performance (system Response) is determined by both the technical specification parameters and the losses, due to lack of perfection.

The Input factors are usually given by predefined service system environments or established traditions and policies.

The Control Parameters, like investments in Quality, are usually tangible, well known and planned factors that can be chosen (set-up) in such a way that the Response will be as near as possible to what the system defines as a goal.

In this model the Source of Noise means variable (undeterminable and random) inputs with unknown levels depending on different customer requests, expectations and unexpected circumstances in the system itself (machine failures, human misunderstanding of requests, inputs and outputs, improper functioning in extreme cases, etc.).

MODEL CONSIDERATION

The system Response representing the combined effect of its functioning parameters and quality losses such as poor performance, requires advance determination of prevention and appraisal elements which are instrumental in achieving the desired results.

This article does not attempt to analyze the various functioning parameters in different service organizations, but concentrates and emphasizes the components of quality loss which can be estimated and quantified in terms of money, time, space and quantity, common across the service industry.

Theoretically it is possible to evaluate and predict the desired level of those losses by defining the acceptable and tolerable limit which in some cases should be defined as zero loss, but in other cases is a final positive target value (e.g., Down time, Quantity of untreated requests, Repair cost, etc.).

The combination of Quality Economics and Qualimetry enables to provide an assessment of the System's Achievement. The achievement is measured by comparison of the actual system response with the objectives defined by management.

The purpose is to build a Qualimetric Achievement Breakdown Structure (Fig. 2) comprised of two branches:

1. Functional parameters.
2. Quality losses.

Each parameter of the Qualimetric Breakdown Structure has a Weighing Factor (or Relative Importance) and a Quality Rating (Fig. 3, 4).

Quality Rating (QR) for a primary quality characteristic is assessed as a function with values in the range from 0 to 1, that is:

$0 \leq Ki = f(Pi) \leq 1$,

where Pi is a discrete or continuous Absolute quality characteristic.

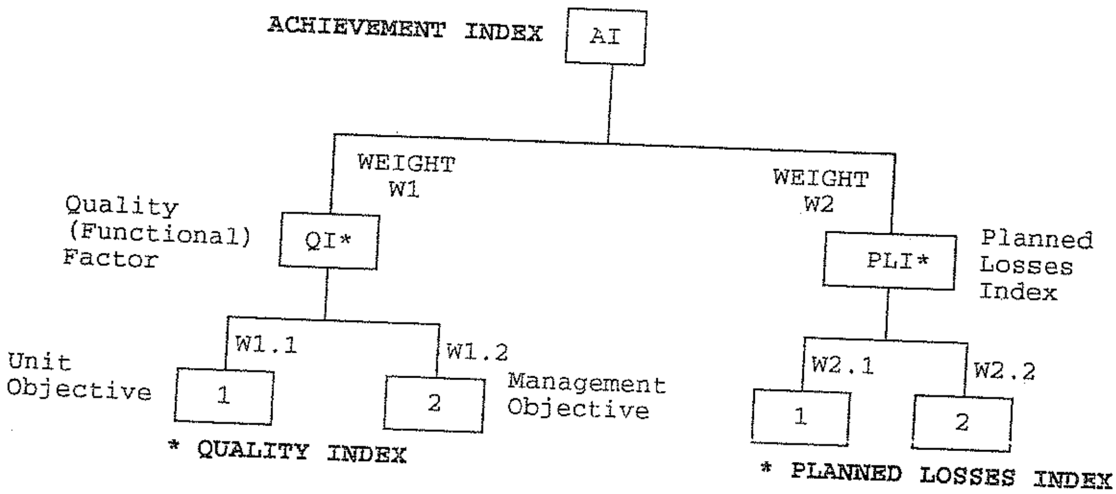

Figure 2. The Qualimetric Achievement Breakdown Structure (fragment)

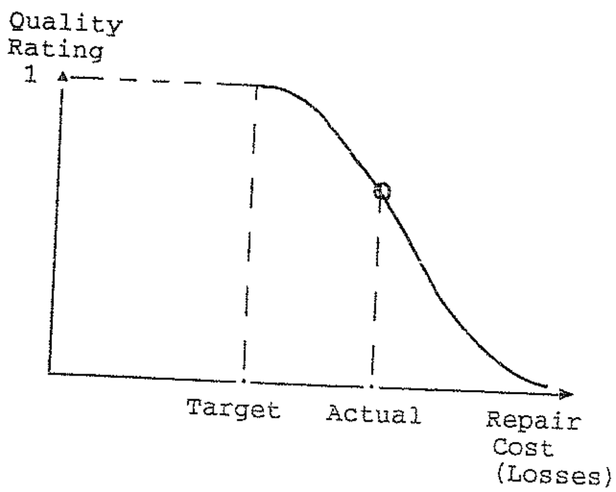

Figure 3. Quality Rating of Repair Cost

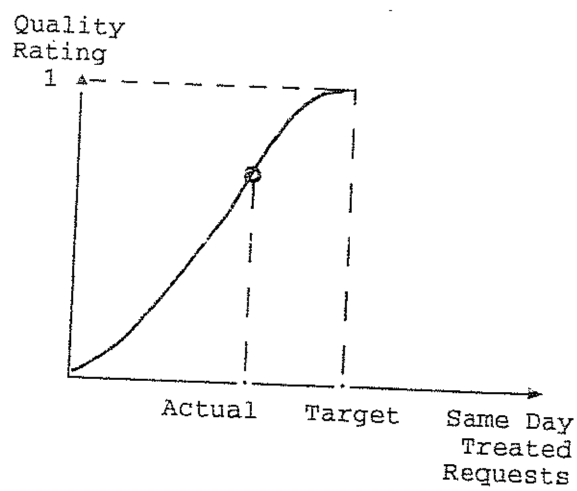

Figure 4. Quality Rating of Treated Requests

Quality Rating function provides transforming of physical continuous characteristic (length, design time delay, etc.) or discrete grade (e.g., Color, Stability of supply, etc.) into the qualimetric scale which is measured over interval from 0 to 1.

As a rule, Quality Rating function should be defined by an expert or expert group.

The relative importance should be defined by management or experts. The actual Achievement Index should be planned in accordance with management objectives and capabilities of the particular unit in the organization, because every unit has its own Sources of Noise, capabilities and input variables (e.g., technology level, number of people, age of hardware, etc.).

The investments in service quality includes various components. Some of them are directly connected with the continuous work plan and as such are not actually defined as preventive costs. Also there are other costs which should be planned by management to decrease unpredictable losses down to a planned level.

Since we are dealing with assessments we have to enable the management to evaluate the achievements by continuous periodical reporting and periodical revision of objectives investing money in Quality improvement.

With this aim, we introduce an Integrated Improvement Index I^3 called "Triple I":

$$I^3 = \frac{AI}{\text{INVESTMENTS FOR QUALITY}}$$

where the Achievement Index is related to investment in Quality thus yielding an effectiveness of one dollar (or 1,000 or 1,000,000 dollars depending on particular project) invested in Quality.

The continuous growth of AI per dollar invested in Quality is a real goal for service organization improvement and may be used as a top-level indicator for Total Quality Program success.

IMPLEMENTATION

This model has been developed and introduced for implementation in one of the typical divisions of a Communication Service Company in Israel and in one bank department in Italy as a joint venture project with TELEbit (Rome, Italy).

The Quality Costs data collection, evaluation and decision making process should normally follow the proposed steps as depicted in Fig. 5.

These projects were performed with the help of a new software tool "**Qualimetrix**" which is intended for Quality assessment. The Qualimetrix software package is based on Qualimetry and enables to perform the following tasks of the full-scale Qualimetric analysis:

1. Create a "tree" of the Quality Breakdown Structure (QBS) for a system / product of any kind. Number of elements in QBS is not limited.
2. Allocate relative importance weights for each QBS tree item.

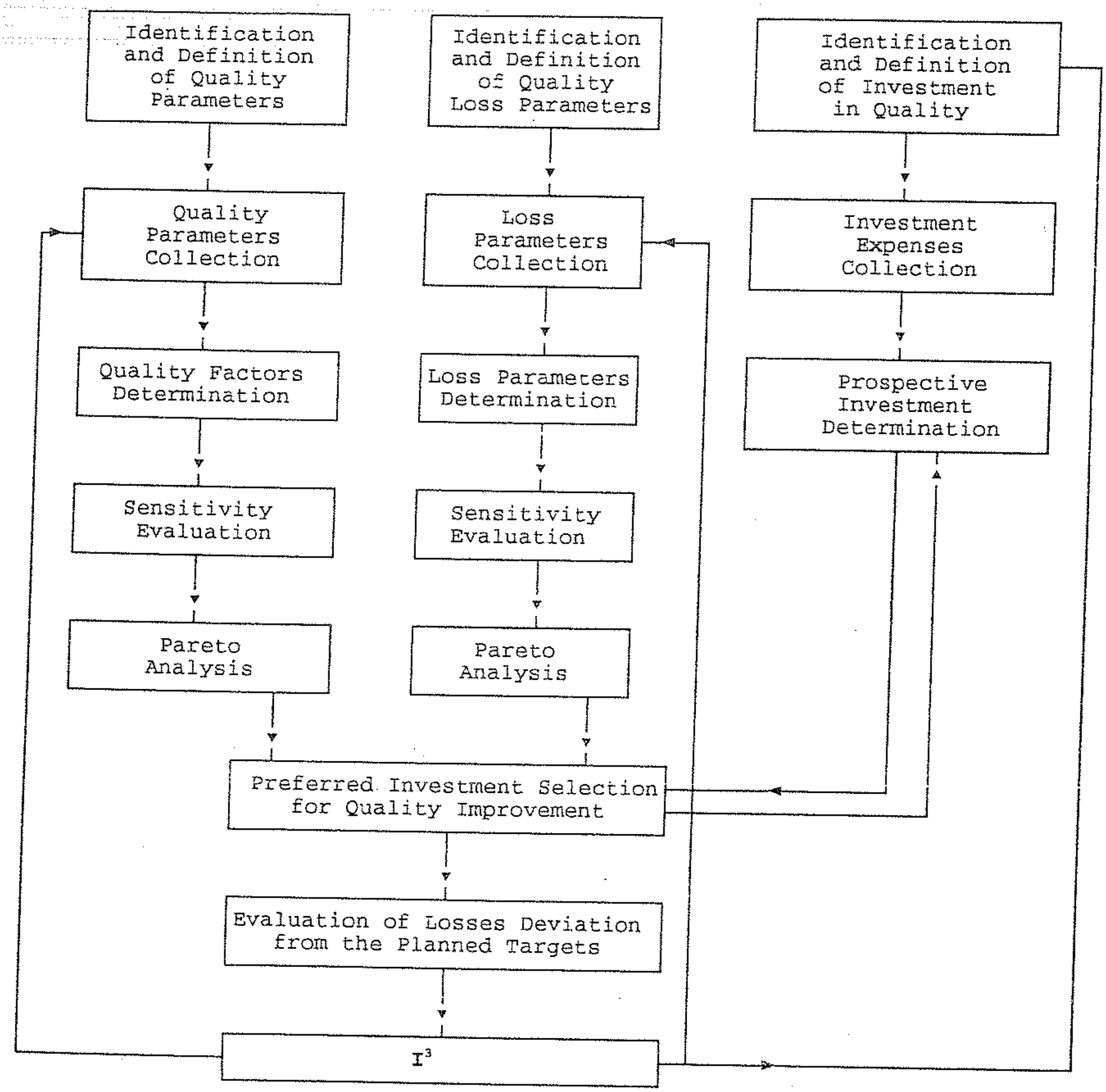

Figure 5. A Flow-chart of Quality Economics Control Process

3. Define as many Experts as necessary along with their relative weights and create a library of Experts and their personal characteristics.
4. Define an item's Quality Rating in one of the 2 forms:
   1) Graph
   2) Rank Table.

5. Specify a set of all feasible alternatives identified for the system / product (e.g., design configurations, TQM improvement directions, alternative products, etc.) and get various reports for comparison and evaluation of the alternatives.
6. Take into account a time factor defining values of any quality index as a function of future periods of time.
7. Calculate an Integrated Improvement Index I^3 for the entire system / product, or a Quality Index for any QBS part (down to a single item) by alternative and period.
8. Perform **Sensitivity Analysis** versus any source Global Variable (attribute) in order to evaluate how this attribute influences an Integrated Improvement Index I^3.

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