Developments in Social Science Methodology
Anuška Ferligoj and Andrej Mrvar (Editors)
Metodološki zvezki, 18, Ljubljana: FDV, 2002

Applying Statistical Tools to Improve Quality in the Service Sector

Irena Ograjenšek[1]

Abstract

Services account for more than 75% of the GDP in most developed countries. It is therefore important to improve quality in this vital sector of the economy. This can be achieved with logical and consistent use of statistical quality control and improvement tools. The term "statistical quality control and improvement" should not be confined only to the use of control charts and other traditional statistical quality control tools. Rather, it should be understood as an all-encompassing deliberate application of statistical tools, simple or more complex, with the goal of achieving product and process quality.

In this paper, the rationale for the application of statistical quality control and improvement tools in the service sector is discussed. Practical examples from different service industries are used throughout the paper to illustrate the concept and the methods.

1 Introduction

Companies that want to improve the quality of their (material and immaterial) products and processes need to concentrate their efforts on the proper exploration of data available in their records. By examining data at hand they can discover previously unnoticed patterns of employee behaviour that slow down their processes and diminish the value of their products. By getting to know their customers better, they are more flexible in responding to their needs and reacting to competitors' attempts to undermine their market position. However, there is one

[1] University Ljubljana, Faculty of Economics, Slovenia; e-mail: irena.ograjensek@uni-lj.si.

This paper was prepared during the author's study visit at the University of St. Gallen's Institute for Technology Management (ITEM), which was financed by the Swiss government study grant. The author wishes to express her sincere gratitude to Professor Søren Bisgaard of ITEM whose guidance, comments and suggestions concerning the contents of this paper and the cases it includes (of which many are products of his work as a consultant) proved to be invaluable in all stages of the draft preparation and paper finalisation.

major problem that all companies – be it in the manufacturing or in the service sector - have to overcome: the aversion to the use of statistical quality control and improvement tools.

This aversion is possibly a consequence of the fact that the word "statistics" brings back unpleasant memories of primary and secondary school struggles with mathematics to many people. Additionally, it probably emerges from a far too narrow understanding of what the statistical quality control and improvement is. The examples of the practical use of statistical tools for quality control and improvement, described in this paper, will show that:

- The term "statistical quality control and improvement" should not be confined only to the use of control charts and other traditional statistical quality control and improvement tools. Rather, it should be understood as an all-encompassing deliberate application of statistical tools, simple and more complex (including the data mining as a popular approach to customer data analysis), with the goal of achieving product and process quality.
- Companies can gain a decisive competitive advantage on the market by a consequent and consistent application of statistical tools.

It has to be pointed out that the issue of perceived or subjective service quality is not addressed in this paper. The focus of discussion lies solely on statistical control and improvement of technical or objective service quality.

2 On services and importance of their quality

In order to define services, it is not enough to say simply that they are intangible acts as opposed to tangible goods. Most modern products[2] are a combination of both. For example, when purchasing a washing machine the customer also receives services such as installation, maintenance and repair. When getting a haircut, the customer will likely also benefit from a number of hair care products and might even purchase some for home use. Therefore, to provide a satisfactory definition of services, some authors (e.g., Mudie and Cottam 1993; Hope and Mühlemann, 1997; Kasper et al., 1999) characterise them with the following important features:

- ***Intangibility*:** services cannot generally be seen, tasted, felt, heard or smelled before they are bought.
- ***Inseparability*:** services are produced and consumed at the same time.
- ***Variability*:** the quality of the same service may vary depending on who provides it as well as when and how it is provided.

[2] In this paper, the term product will be used for both material and immaterial products (goods and services).

- ***Perishability*****:** services cannot be stored for later sales or use; lack of demand cannot be evened out by producing to an inventory.

A distinguishing service feature, related to the interface with the customer, is most visible in the highly specialised segment of ***personal high-contact services***. There, the customer needs to be physically present when receiving a service because the production and the delivery process are interdependent and thus inseparable.

On the other hand, several of the features enumerated above do not apply to ***modern information technology-based services***. There, personal contact does not have any importance (e.g., on-line learning in its purest form, on-line banking, etc.) and variability is greatly reduced if not eliminated completely.

Due to this heterogeneity in services it is difficult to classify them in a useful manner. However, the classification developed by Lovelock appears useful because it provides answer to the question "Why is service quality important?".

Table 1: Classification of services by Lovelock (Maudie and Cottam, 1993).

Types of Services	**Examples**
Tangible actions directed at people's bodies.	Health care Passengers transportation Hotels and restaurants Beauty care
Tangible actions directed at goods and other physical possessions.	Freight transport Industrial equipment Repair and maintenance Janitorial services Laundry and dry cleaning Veterinary care
Intangible actions directed at people's minds.	Education Broadcasting Information services Theatres Museums
Intangible actions directed at intangible assets.	Banking Legal services Accounting Securities Insurance

All of the service examples stated in the Table 1 are an integral part of people's every day lives – so much so, that individuals are in most cases unaware of their special "service" nature and take them for granted. However, should something go wrong (e.g., with the quality of such a complex service as an education, or such a simple one as a haircut), people usually swiftly react to protect their interests by choosing among a variety of options; the most unfortunate for the service provider being "the exit option"[3].

Irons (1997) has pointed out that growth and importance of services often come as a response to the wider forces which are creating change in our society. Over the past few decades, the focus of the society has shifted from the acquisition of products to their use: from the need to possess to the concern for function and use, where "delivery becomes as important as the product itself". For example, rather than providing the customer with the possibility of renting a van, service companies now offer a number of van services such as rental vans for do-it-yourself moving or chauffeur driven vans. Also, in more affluent societies the range and volume of services tend to increase. This and the myriad of new services facilitated by modern information technology will significantly increase the importance of the service sector in the future.

Often, the term "service revolution" is used to describe a paradigm shift in customers' service quality expectations and in the way service providers work. Quality is inherently a part of service – even the word service is in some interpretations synonymous with quality. Thus, in a free market economy with many service providers competing for the customers, the service quality is a critical element that helps creating the extra competitive edge needed for the service providers' long-term survival.

3 Statistical quality improvement

According to Juran (1999), quality can be defined as ***fitness for use***. The term can also be understood as ***features of the product*** which meet customer needs and thereby provide customer satisfaction and as ***freedom from deficiencies*** – errors that require rework or result in field failures, customer dissatisfaction and claims etc.[4]

The latter two definitions can help avoiding a good deal of confusion when discussing quality issues. One key reason is that some service providers may resist quality improvement efforts because they implicitly think in terms of more features (which may be more expensive) and not in terms of lack of deficiencies (which usually cost less and therefore figure as a cost saving strategy).

---

[3] As Tyrell (Irons, 1997) put it, our society can be described as an ***exit culture***, where "the choice is wide and we can do anything. As a result, business is much more transaction based and if it does not work we have no loyalty to stay – we simply exit." Service quality should create positive reasons to stay.

[4] More features do not necessarily mean better quality. If someone needs a cheap hotel for resting during a business trip but is offered an expensive luxury suite at a resort hotel instead, this might not satisfy his or her need to sleep in a cheap but tidy and neat room. Thus, what counts are features that are regarded by customers as necessary. However, customers are always prepared to embrace what Kano (Joiner, 1994) describes as "delighters" – features that surprise them in a positive way.

The term “quality management” is currently undergoing a transition from a traditional to a more advanced interpretation. The traditional belief that companies’ quality departments own quality (Hoerl, 1998) seems to be disappearing. A trend from what Juran calls the “little q” to what he terms the “Big Q” has been noted. The differences between the two quality concepts are shown in Table 2.

Table 2: The “little q” versus the “Big Q” (Juran, 1999).

Topic	**Little q**	**Big Q**
Products	Manufactured goods	All products: goods and services
Processes	Processes directly related to manufacturing	All processes
Customers	Clients who buy products	All who are affected – externally and internally
Industries	Manufacturing	All: manufacturing and service; private and public
Costs of poor quality	Costs associated with deficient manufacturing goods	All costs that would disappear if everything were perfect
Statistical improvement	Mostly sampling procedures (inspection)	All statistical methods used consistently during a lifetime of a product

In the broader “Big Q” framework the traditional assumption that statistical quality control and improvement methods involve only the use of control charts is too narrow. Modern statistical quality control and improvement include all statistical methods (simple and complex) used to improve manufacturing as well as non-manufacturing processes.

In order to improve quality in the service sector it is important to realise that every process generates information that can be used for its improvement. No organisation, be it public or private, manufacturing or service, should neglect the opportunity to take a close look at accumulated data as part of the operations. With this data it is possible to discover hidden patterns in process deficiencies, form different hypothesis as to what might be the reasons for deficiencies, etc. – in short: use the scientific method[5] to increase profitability and competitiveness of the organisation as a whole by improving processes and customer satisfaction.[6]

4 Statistical tools for improvement of service quality

4.1 Basic statistical toolbox

The basic statistical toolbox includes a set of seven tools popularised by Kaoru Ishikawa (it has to be pointed out that all of them are not – strictly speaking – statistical tools but rather brainstorming and mind-mapping utensils). Among them are check sheets, the Pareto chart, the cause-and-effect diagram, histograms, stratification, scatter plots and graphs (including the control chart). Simplicity of use is their strength and common characteristic. They help people see how often things happen, when and where they happen and in what different forms they may present themselves to the observer. Therefore, we may speak of "informed observations" when conducting a simple search for assignable causes of variation in products and processes (Box and Bisgaard, 1987).

Let us consider two examples, which illustrate the use of basic statistical toolbox in the service industry.

Example 1. Bisgaard (1997) describes serious problems the city of Madison in Wisconsin (USA) had with the service garage for police cars, garbage trucks and other vehicles. A flowchart of the repair process and a Pareto chart were constructed from the data collected in a customer satisfaction survey. The Pareto chart showed that a major problem was the so-called "down time" – time between the reporting of an existence of a defective vehicle and its delivery back to the customer. A two-month observational study of the process revealed that approximately 80% of the down time were spent waiting (for parts, assembly, paper work to be done, etc.). Further analysis showed that these problems were caused by factors such as e.g., lack of spare parts. This in turn was a consequence of the city's vehicle purchasing policy of buying at the lowest bid. Therefore, the city's car park consisted of a large number of different types of vehicles, and different types of spare parts had to be kept in inventory or be ordered from the

[5] The ***scientific method*** is the basis of the so-called Shewhart cycle, later modified and popularized by Deming as the Plan-Do-Check-Act (PDCA) cycle. Its backbone elements are problem recognition and formulation, data collection, planned experimentation, hypothesis generation, predictions preparation and predictions comparison and testing. These elements may be applied in different order although they have to be used iteratively (Bisgaard, 1997). Different elements demand different levels of quantitative literacy.

[6] As Beauregard et al. (1992) put it: "The goal of every business must be to understand, to control and to improve (reduce) the differences in processes in order to reduce the variation in goods and services" and guarantee consistent level of their quality. Obviously, variation can not be reduced if it is not measured – and it can not be measured without proper statistical tools.

outside. Another serious problem was the lack of preventive maintenance policy, resulting in transformation of minor into major and costly problems to deal with.

After the mechanics had flowcharted the repair process and performed the statistical analysis of data from the process, they made a presentation of their results to the Mayor. Upon evaluating the results, the Mayor changed the city's vehicle purchasing policy and the car park was standardised. The spare parts inventory was made more efficient, which resulted in waiting time and cost reduction. A preventive maintenance programme was also initiated. Shortly after implementation of these initiatives, significant returns on investment could be noticed. For example, an audit a year later showed that the average downtime was reduced by 14%, the number of vehicle breakdowns was reduced by 57%, and the maintenance cost was down by 23%. Additionally, the average cost of repair was reduced from $395 to $214, and the average total repair downtime was reduced by about 15% within a year.

Example 2. The President of a relatively small mortgage-lending bank facing a serious competition of similar larger institutions had decided that in order to survive in the market for home mortgage loans, excellent service should be the bank's trademark. As part of a larger initiative, a selected team conducted a preliminary statistical study of transaction data. Team members found out that the average time to complete a loan (the elapsed time from the moment a homeowner approached the bank until the loan was granted) was 24 days. This was not unusual in comparison with competitors. However, a market analysis showed that a shorter time period to obtain a home loan would give the bank a significant advantage over the competitors. The bank's President nominated a team to work on reducing the waiting time for the loans approval.

After flowcharting the process on the basis of available transaction data and observing the processing of new loans for 3 months, the team found out that enormous time savings could be achieved. A Pareto chart indicated that an overwhelming part of the elapsed time was due to the documents travelling between various offices since they had to be read and approved by so many different people. Further analysis showed that the steps in the process could be combined, and get done by one person. This could greatly reduce both the waiting time and the potential for errors.

As a consequence, a set of standard operating procedures was prepared for the new process. After the system changes were implemented, a statistical study showed that the average time to obtain a home loan was reduced to 4 days, providing this bank with a significant advantage over its competitors.[7]

Lessons learned. Conducting observational studies and using simple statistical tools such as Ishikawa's Seven Tools and flowcharts to organise and visually present data can be an effective way of finding patterns and links between causes

[7] Source: IE Graduate Student Project, University of Wisconsin-Madison/USA. The project evaluator was Professor Bisgaard, at the time the faculty member of this American university.

and effects in the observed phenomenon. As illustrated in the examples above, the tools do not necessarily require sophisticated statistical skills, but can provide an excellent basis for the application of sound logic problem solving. The data and their analysis act as catalysts for thinking and stimulate understanding of the observed phenomenon.

4.2 Extended statistical toolbox

Observational studies are appropriate in many situations but sometimes no amount of fine-tuning can overcome fundamental flaws in products and processes due to poor design. Designing quality into products and processes is therefore a top priority and sophisticated statistical methods such as statistical experimental designs may be more appropriate for attaining better (optimum) values of important quality characteristics of products and processes (Box and Bisgaard, 1987).

As the following examples show, experimental methods can also be used in the service sector. Factors influencing service quality can be deliberately changed. Afterwards, the effects of changes have to be closely examined to determine how they affected the service or the service delivery process.

Example 1. Bisgaard (1997) describes an example of a U.S. credit card institution. Such companies regularly send out large mailings to stimulate potential customers to sign up for their credit cards. To increase the response rate, this particular company hired a consulting company with expertise in design of experiments. In collaboration with the company's marketing department they conducted a large-scale factorial experiment, where different mailing components (e.g., colour, envelope size, character type, text, etc.) were systematically changed. The experimental results showed that one particular factorial combination increased the response rate by a few percentage points. Even though the increase was relatively modest it produced millions of dollars in new business.

Example 2: Newspapers apply factorial experiments to the layout of their front pages, trying to determine which factorial combination of colour, character type and size, the way the page is organised, the way the main issue is emphasised, etc. influences the sales volume the most. By applying the experimental combinations to randomly selected geographical areas the factorial experiment may show that certain factor combinations influence the circulation.

Example 3: On-line retailers are beginning to experiment with the design of their commercial web sites, trying to increase the number of visits and – consequently – the number of sales. Known is an example of a company using its on-line catalogue to test price elasticity of its customers.

Lessons learned. Experiments with influential factors have a great future potential in the service sector. They can be used to either improve an existing service delivery process (process improvement) or to design new services in the quality planning process (product development). The use of more sophisticated statistical methods can be facilitated by modern user-friendly menu driven statistical software. However, more than only statistical skills is required to use experiments successfully. Without knowing the subject matter the experiment or survey planning and data interpretation are of limited use and very likely do not have the desired impact.

4.3 Data mining

According to Davidow and Uttal (1989), the essence of any customer service strategy is to segment the customers to be served with the goal of concentrating all efforts on a homogenous set of customers that can be served at a profit.[8] Information technology can be used to gain better understanding of the customers and help identify homogeneous customer subgroups that can be served with services tailor made to their needs and expectations. This can be achieved by creating large customer databases (***data warehouses***) and using sophisticated, IT-supported statistical tools to explore, evaluate and exploit data accumulated over time. The result of this process (popularly called ***data mining***) is information with great potential value for designing new as well as optimising exiting designing new as well as optimising existing products and processes[9]. A few examples will illustrate the potential of data mining for improving service processes and generating ideas for new services[10]:

- Heating oil dealers maintain data on the capacity of their customers' tanks, on habitual consumption rates and on weather. This way, they can program oil deliveries to provide close to 100% availability while saving costs on delivery times and the number of necessary trucks and drivers.
- Companies servicing manufactured goods build databases on the types, wear rates and failure rates of various parts of these goods (e.g., furnaces, appliances or automobiles). They can use this information for sending timely service reminders to customers and also to manage parts inventories.
- Credit card services build expenditure profiles for their customers. Sudden unusual patterns may signal fraudulent use of cards. For example theft can

[8] As Reichheld and Sasser (1990) put it: "Achieving service quality doesn't mean slavishly keeping all customers at any cost."

[9] Invaluable are e.g., results of shopping basket analysis, analysis of sales, repeat purchase analysis, transactions analysis, overall performance trend analysis, stock analysis, defections analysis etc. Ranking reports and individual customer profiles which are also results of database queries enable a more focused response to customer needs and demands.

[10] The first three examples are taken from Heskett (1987). The utilization of bar-code scanners is described in Quinn and Gagnon (1986). The rest of the examples were presented to the author during interviews with senior management of the companies, which are regarded as excellent service providers in their respective countries (Switzerland, Germany and the Netherlands).

be suspected if large expenditures are made far from the cardholder's address.

- Bar-code scanners give retailers instant feedback on their sales and inventory movements. Customer cards allow them to link individual purchases to names, addresses and demographic profiles, thus giving them opportunity to get to know their customers' preferences[11].
- Members of networks including banks, insurance companies, airlines and retailers can profit from comparisons of their customers' expenditure patterns, tracking down habitual patterns and trying to identify customer segments for which new services could be developed.

Few companies that maintain large customer databases will need to buy data since their transactional databases can be converted to internal know-how. In some cases it might be beneficial for companies to pool their databases with that of their partners (a term ***data pooling*** is deemed appropriate to describe this phenomenon) as companies offering loyalty schemes beyond boundaries of individual industries found out in the negotiation processes[12]. However, such use may run into legal restrictions and ethical problems and should therefore be approached with care.

5 How to overcome the aversion to the use of statistical methods

History should teach us that people fear phenomena they do not know or comprehend. Mathematics and statistics are regarded as fields for a few chosen with special abilities. Yet efforts to improve people's quantitative literacy can pay off dramatically, as the ***Six Sigma initiative*** at General Electric shows (Hoerl, 1998)[13].

---

[11] In case of a popular retailer in the Netherlands, a database analysis revealed that senior customers were buying rather unusual quantities of rock and pop music CDs. Further checking showed they were buying them for their grandchildren. The retailer decided to prepare quarterly mailings with information on current musical preferences of the youth. As a result, the CD sales tripled.

[12] Loyalty programs are transcending their role as creators of exit barriers. Regarded as facilitators of data collection, they help segmenting the customer base and reshaping the database profile. This way, they are instrumental in achieving service quality on the basis of objective facts (e.g., customer purchase patterns) rather than subjective opinions obtained in complex customer surveys.

[13] The ***Six Sigma initiative*** is "a program aimed at the near-elimination of defects from every product, process and transaction" (Hoerl, 1998). It is a disciplined quantitative approach for improvement of defined indicators (called "metrics") in all types of business processes. Initially introduced by Motorola and widely used in giants such as General Electric, the initiative has a broad business character: quality improvements are seen as ground stones for huge cost savings which is a component, usually neglected when establishing a quality system "per se" – because the customer wants to see a tangible proof of our company's dedication to quality issues.

In the era of the institutionalised quality movement, having an ISO-certified quality system is no guarantee for the proper use of quantitative (statistical) tools to achieve quality. Empirical evidence from Slovene companies (Ograjenšek, 1998) suggests that regarding their inclination towards the use of statistical tools in a quality system, three types of companies with ISO-certified quality systems exist[14]:

- ***"enlightened"*** – those actually using the methods;
- ***"self-satisfied"*** – those being aware of their importance but at present not using them because due to (still) favourable competitive position they do not have to;
- ***"careless"*** – those presently not using the methods and not planning to use them in the future either.

For each group of companies, appropriate activities and measures for integration of statistical tools into a quality system can be identified. All are based on the systematic training of employees for the proper use of statistical methods and on the co-operation of expert statisticians in integration processes.[15] Additionally, the following points should be emphasised in each of the identified groups:

- ***In the group of "enlightened" companies:*** regular audits of the appropriateness of the use of statistical quality control methods and introduction of new methods if they help companies reduce costs.
- ***In the group of "self-satisfied" companies:*** intensive employee training with the emphasis on the use of modern statistical software tools.
- ***In the group of "careless" companies:*** motivating top managers and training middle managers for the use of statistical quality control methods.

Promotion of statistical quality control and improvement tools and their integration into quality systems has to be performed both at the micro and the macro level.

At the micro level, expert statisticians should participate in regular audits of the appropriateness of the use of statistical methods for quality control and improvement – not as hostile evaluators but in the role of friendly consultants as Kim and Larsen (1997) suggest.

At the macro (national and international) level, professional associations such as European Organisation for Quality as well as various national and international statistical associations should co-operate more closely and perhaps even jointly establish a new company award for excellent achievements in statistical quality

[14] It is fairly probable that similar conclusions could also be made if based on a sample of companies from any European country or the United States. The qualitative research done by Kim and Larsen (1997) in American pharmaceutical industry supports this assumption.

[15] E.g., as described in Kim and Larsen (1997).

improvement integration into quality systems and for continuous employee training for the proper use of statistical methods.

Last but not least, the academia should also play a vital role in these endeavours.

6 Conclusion

It was stated in the introduction that companies which want to improve their product and process quality need to concentrate their efforts on the proper exploration of (internal and external) data ***available in their records***. That way, they can become more flexible in responding to customer needs and reacting to competitors' attempts to undermine their market position.

To achieve this flexibility, companies should improve the quantitative literacy of their employees. Initiatives such as the Six Sigma or Kim and Larsen's proposal should be adopted in companies of different size in all sectors of the economy. Special attention should be given to the service sector, which embraced the basic quality improvement ideas simultaneously with the manufacturing sector, but has been neglecting the use of statistical quality control and improvement tools even more than its manufacturing counterpart.

References

[1] Beauregard, M.R., Mikulak, R.J., and Olson, B.A. (1992): *A Practical Guide to Statistical Quality Improvement. Opening up the Statistical Toolbox*. New York: Van Nostrand Reinhold.

[2] Bisgaard, S. (1997): The Role of Scientific Problem Solving and Statistics in Quality Improvement: Some Perspectives. In *Proceedings of the 41st Congress of the European Organization for Quality*, **2**, 179-190.

[3] Box, G.E.P. and Bisgaard, S. (1987): The Scientific Context of Quality Improvement. A Look at the Use of Scientific Method in Quality Improvement. *Quality Progress*, June, 54-61.

[4] Davidow, W.H. and Uttal, B. (1989): Service Companies: Focus or Falter. *Service Management, A Harvard Business Review Paperback*, 3-11.

[5] Heskett, J.L. (1987): Lessons in the Service Sector. *Service Management, A Harvard Business Review Paperback*, 12-20.

[6] Hoerl, R.W. (1998): Six Sigma and the Future of the Quality Profession. *Quality Progress*, June.

[7] Hope, C. and Mühlemann, A. (1997): *Service Operations Management. Strategy, Design and Delivery*. London: Prentice Hall.

[8] Irons, K. (1997): *The World of Superservice. Creating Profit through a Passion for Customer Service*. Harlow: Addison-Wesley.

[9] Joiner, B.L. (1994): *Fourth Generation Management. The New Business Consciousness. How the Evolution of Management and the Revolution in Quality are converging, and What it means for Business and the Nation*. New York: McGraw-Hill.

[10] Juran, J.M. (1999): How to think about Quality. In J.M. Juran, A.B. Godfrey, R.E. Hoogstoel, and E.G., Schilling (Eds.): *Quality-Control Handbook*. New York: McGraw-Hill.

[11] Kasper, H., van Helsdingen, P., and de Vries, W. Jr. (1999): *Services Marketing Management. An International Perspective*. Chichester: John Wiley & Sons.

[12] Kim, J.S. and Larsen, M.D. (1997): Integration of Statistical Techniques into Quality Improvement Systems. In *Proceedings of the 41st Congress of the European Organization for Quality*, **2**, 277-284.

[13] Mudie, P. and Cottam, A. (1993): *The Management and Marketing of Services*. Oxford: Butterworth-Heinemann.

[14] Ograjenšek, I. (1998): *The Role of Statistical Quality Control in the Total Quality Management System*. Master Thesis: University of Ljubljana, Faculty of Economics. Ljubljana. [In Slovene]

[15] Quinn, J.B. and Gagnon, C.E. (1986): Will Services follow Manufacturing into Decline? *Service Management, A Harvard Business Review Paperback*, 21-29.

[16] Reichheld, F.F. and Sasser, W.E. (1990): Zero Defections: Quality comes to Services. *Service Management, A Harvard Business Review Paperback*, 41-47.