

Iso 9000, service quality and ergonomics stanislav karapetrovic

[Business](#), [Marketing](#)



To cite this document: Stanislav Karapetrovic, (1999)," ISO 9000, service quality and ergonomics", Managing Service Quality, Vol. 9 Iss: 2 pp. 81 - 89
Permanent link to this document: <http://dx.doi.org/10.1108/09604529910257948> Downloaded on: 17-10-2012 References: This document contains references to 27 other documents Citations: This document has been cited by 3 other documents To copy this document: com This document has been downloaded 1952 times since 2005. * Users who downloaded this Article also downloaded: *

Rujirutana Mandhachitara, Yaowalak Poolthong, (2011)," A model of customerloyaltyand corporate socialresponsibility", Journal of Services Marketing, Vol. 25 Iss: 2 pp. 122 - 133 <http://dx.doi.org/10.1108/08876041111119840> Harold W. Webb, Linda A. Webb, (2004)," SiteQual: an integrated measure of Web site quality", Journal of Enterprise Information Management, Vol. 17 Iss: 6 pp. 430 - 440 <http://dx.doi.org/10.1108/17410390410566724> Rabiul Ahasan, Daniel Imbeau, (2003)," Who belongs to ergonomics? An examination of the human factors community", Work Study, Vol. 52 Iss: 3 pp. 123 - 128 <http://dx.doi.org/10.1108/00438020310471917>

Access to this document was granted through an Emerald subscription provided by ISLAMIC UNIVERSITY OF GAZA For Authors: If you would like to write for this, or any other Emerald publication, then please use our Emerald for Authors service. Information about how to choose which publication to write for and submission guidelines are available for all. Please visit www.emeraldinsight.com/authors for more information. About Emerald www.emeraldinsight.com

emeraldinsight. com With over forty years' experience, Emerald Group Publishing is a leading independent publisher of global research with impact in business, society, public policy and education.

In total, Emerald publishes over 275 journals and more than 130 book series, as well as an extensive range of online products and services. Emerald is both COUNTER 3 and TRANSFER compliant. The organization is a partner of the Committee on Publication Ethics (COPE) and also works with Portico and the LOCKSS initiative for digital archive preservation. *Related content and download information correct at time of download. Perspectives ISO 9000, service quality and ergonomics Stanislav Karapetrovic 1. Introduction In the last decade or so, we have witnessed an explosion of quality-related standards and regulations.

As a result of the continuous quest for better “ quality” of products and services offered to customers, the International Organization for Standardization introduced the ISO 9000 series of quality management and quality assurance standards in 1987. The series currently includes three models for quality assurance (ISO 9001, ISO 9002 and ISO 9003), guidelines for quality management (ISO 9004), and two supporting documents: ISO 9000 Guidelines for Model's Selection and Use and ISO 8402 Quality Vocabulary (Figure 1). The ISO 9000 standards have been accepted worldwide, with more than 200, 000 organizations already registered.

The standards present a sound basis for assuring the customer of quality of products and services, as well as the processes that create them. Several other quality-related standards have since emerged, such as the automotive

standards QS 9000, environmental management standards ISO 14000, and emerging health and safety international standards (Figura, 1996). The upcoming revision of ISO 9000 standards in the year 2000 (now in the form of a Technical Committee Draft) is expected to further facilitate the use of quality assurance methods the world over.

Another commonly used phrase from the 1980s and 1990s has been total quality management (TQM): an integrated approach to the management of quality with special emphasis on delighting customers and improving the wellbeing of all employees in the organization. A number of articles have been written on the relationship between the ISO 9000 series and TQM (Johnson, 1993; Struebing, 1996; Wilson, 1996; Velury, 1996; Corigan, 1994; Sakofsky, 1994; Emmons, 1994), underlying the opinion of quality management professionals that the two are not quite the same.

While ISO 9000 series are technical, presenting specifications, requirements and guidelines for quality systems, TQM emphasizes teamwork and customer satisfaction. Put another way, TQM is quality management with “a human touch”. Does this mean that ergonomic aspects of the workplace and customer satisfaction are not emphasized by ISO 9000? Does quality assurance (ISO 9000) emphasize ergonomics and 81 The author Stanislav Karapetrovic is based at the Department of Industrial Engineering, Dalhousie University, Halifax, Nova Scotia, Canada.

Keywords Ergonomics, ISO 9000, Quality assurance, Service quality, Workers

Abstract This paper addresses some ergonomic issues in the ISO 9000-based quality assurance. Ergonomics – the study of human factors in engineering

and design of systems is briefly touched on. Then, outlines of ISO 9001 and ISO 9004 quality system models are provided, and all 20 requirements of the current ISO 9001: 9004 standard are presented in an ergonomic light. Subsequently, human factors in the documentation and implementation of a quality system are illustrated.

The relevance of ergonomic studies in the development of service systems is addressed. Finally, a blueprint for an ergonomic assurance system, defined as a set of interrelated resources and processes that function in order to achieve objectives related to ergonomic design and use of products and processes, is provided. Managing Service Quality Volume 9 · Number 2 · 1999 · pp. 81–89 © MCB University Press · 0960-4529 Figure 1 Ergonomics – an essential element of the production and/or service system

Raw Material RESOURCES Ergonomics PROCESS PRODUCT Output Input
Ergonomics COST ERGONOMICAL CHARACTERISTICS QUALITY
CHARACTERISTICS occupational health and safety? In the present time of globalization of markets and internationalization of best-practice standards, such questions can and should be posed. This paper addresses some of the ergonomic issues in the ISO 9000-based quality assurance. Ergonomics, that is the study of human factors in engineering and design of systems, is briefly touched on.

Then, outlines of ISO 9001 and ISO 9004 quality system models are provided, and all 20 requirements of the current ISO 9001: 9004 standard are presented in an ergonomic light. Subsequently, human factors in the documentation and implementation of a quality system are illustrated. The

relevance of ergonomic studies in the development of service systems is addressed. Finally, the design of an ergonomic assurance system based on ISO 9000 is discussed. 2. Ergonomics It seems that it takes a disaster, loss of human life, or a health crisis for most of us to realize how important human factors are.

Before the Three Mile Island incident, the Chernobyl explosion, the Bhopal pesticide leak, plane crashes involving human errors, or findings that millions of people suffer from repetitive stress injuries, it would have been hard to find anyone who knew what ergonomics or human factors engineering are (not including the ergonomists themselves, of course). Today, however, we often hear about “ergonomically designed computer mouse and keyboard”, “ergonomic” chairs, pots, pans, door handles, and automatic teller machines (ATM).

We now know that ergonomic design of products and processes is absolutely crucial for effective and efficient work. Ergonomics, or human factors engineering, deals with the design for human use, as well as optimizing working and living conditions (Sanders and McCormick, 1993). The first term (ergonomics) is mainly in use in Europe, while the second (human factors engineering) is often heard in North America. The following definition, modified from Chapanis (1985), is provided: Ergonomics discovers and applies information about human behavior, limitations, abilities and other human characteristics to the design of systems for efficient, safe, comfortable and effective human use.

Interested readers are referred to a classic in ergonomics, Sanders' and McCormick's "Human factors in engineering and design" (1993), for more information on the history of the science and a detailed study of many applications of ergonomics. Ergonomics, almost by default, is implied in quality assurance. Quality assurance encompasses techniques used to provide confidence to customers that their requirements for quality are met. Therefore, by definition, human factors are involved. Assurances in the quality of products and services are provided to humans, by humans.

In fact, ergonomics and quality assurance are so intertwined that it is impossible to say where one starts and the other ends. Several articles in ergonomics literature have already discussed the use of quality assurance techniques in human factors engineering (for instance, see Helander and Burri, 1995; Bergquist and Abeysekera, 1996). For an early account on human factors in quality assurance, the reader is referred to Harris and Chaney (1969). Hence, in the following sections, interrelationships between ergonomics and quality assurance will be addressed. 3.

Quality Assurance (ISO 9001) and Management (ISO 9004) Of the three available models for quality system registration, ISO 9001 is undoubtedly the most comprehensive and most widely used. The current version (ISO 9001: 1994), includes 20 elements (requirements), to which a quality assurance system of an organization is assessed (Table I). ISO 9001 covers design, development, production, installation and servicing activities. It is aimed at providing confidence to internal and external customers that their requirements for quality are continuously met.

An organization's management is the main internal customer, while external customers include consumers of the organization's products and services, as well as registrars that assess the suitability and effectiveness of the quality system. ISO 9001 is a generic standard, which means that it is universally applicable to both manufacturing and service organizations, i. e. small businesses (Karapetrovic et al. , 1997), health care and education (Willborn and Cheng, 1994). Rather than focusing on specific products and services, ISO 9001 addresses quality systems and processes influencing the product throughout its lifecycle.

A quality system can be defined as a set of processes that function harmoniously, using various resources, to achieve quality objectives (Karapetrovic and Willborn, 1998A). It is in the interaction of human, material and information resources, as well as human resources and processes, that the ergonomic aspects of the quality system emerge. Focusing on the underlying concept of a system will help us understand the interrelationships between the quality and ergonomic system, and provide a possibility for integration.

Apart from ISO 9001, a set of guidelines numbered ISO 9004 is widely used for developing and implementing quality management. The set currently consists of eight documents, ranging from the guidelines on quality management in service organizations to configuration and project management. For the purpose of discussing an ergonomic system in services, we turn our attention to the second document in the series, namely

the ISO 9004-2 (1994) “ Quality management and quality system elements: Guidelines for services”).

In essence very similar in scope and structure to ISO 9001, ISO 9004-2 provides guidelines for establishing quality management throughout the service life cycle, starting from establishing the need for a service, through service design, acquisition of resources, service delivery and status, as well as performance analysis and improvement. Differing from ISO 9001, these guidelines directly address interfaces with customers, including “ creating a perception of the appropriate image based on the reality of actions taken to meet customers needs” (ISO 9004-2: 1994).

Effective communication with customers, “ listening to them and keeping them informed”, is particularly emphasized. What is also important from an ergonomic standpoint is that the guidelines provide the basis for adequate training of personnel, including motivation, staff development and communication. Although the training mentioned therein mostly involves “ quality system training”, it could be expanded to environmental, health and safety, and ergonomic system training.

For different strategies of using the quality system framework for developing other management systems, including environment and ergonomics, the reader is referred to Karapetrovic and Willborn (1998B and 1998C). In addition to ISO 9004-2, another standard from the ISO 9004 series, namely ISO 9004: Part 1 “ Guidelines for quality management and quality system elements”, addresses some particular ergonomic aspects. This is done in the standard’s 19th element: Product safety. Specifically, it is suggested that “

consideration be given to identifying safety aspects of products and processes with the aim of enhancing safety” (ISO 9004-1: 1994).

Steps to achieve this can include: • identifying relevant safety standards; • performing design evaluation tests for safety; • analyzing instructions and warnings to the user; Table I Ergonomic issues and implications of ISO 9001 (1994) ISO 9001 element 4. 1 4. 2 4. 3 Management responsibility Quality system Contract review Ergonomic issues Organization ensures that the quality policy is understood at all levels Procedures and work instructions are effectively documented/implemented Customer requirements are adequately defined and documented

Implications Quality system documentation should be designed and implemented using ergonomic (human factors engineering) knowledge Ergonomic characteristics of a product, such as environmental conditions, sensory characteristics proper handling and packaging should be determined (see Bergquist and Abeysekera, 1996; Helander and Burri, 1995; Barsky and Dutta, 1997) Products should be ergonomically designed to ensure healthy and safe functioning Quality system documents should be accessible . 4 4. 5 Design control Document control 4. 6 4. 7 4. 8 4. 9 Purchasing Control of customer supplied product Product identification and traceability Process control 4. 10 Inspection and testing 4. 11 Inspection and test equipment 4. 12 Inspection and test status 4. 13 Nonconforming product 4. 14 Corrective and preventive action 4. 15 Handling, storage, ..., delivery 4. 16 Control of quality records 4. 17 Internal quality audits 4. 18 Training 4. 19 Servicing

Crucial characteristics for safe and proper functioning of the product are identified. Appropriate documents are readily available at all locations where essential operations are performed. Purchasing documents adequately address specified requirements. Adequate procedures for storage and maintenance of the product are in place. Product is adequately identified and traceable. Suitable equipment and working environment are used. Criteria for workmanship is stipulated in the clearest practical manner. Records clearly illustrate the results of inspection and testing activities. Suitable indicators of calibration status are identified. Inspection and test status of the product is identified by suitable means. Nonconforming products are adequately identified and segregated. Appropriate sources of information are used to detect and eliminate potential/ existing causes of defects. Adequate handling, storage, packaging, preservation and delivery of the product is identified and maintained. Quality records are adequately identified, indexed, filed and stored.

Quality records are easily accessible. Quality audits are performed to examine the suitability and effectiveness of the quality system. Training needs are identified and adequate training provided. Appropriate identification of servicing needs and customer feedback is performed. Ergonomic techniques can be used to ensure clear understanding of documents. Safe and risk-free storage and maintenance of products is emphasized. Identification of products should be performed according to ergonomic guidelines/regulations. For identification and maintenance of the suitable working environment and hardware, ergonomic analysis and evaluations must be performed. Identification of products and equipment should be performed

according to ergonomic guidelines and regulations (for example, see Sanders and McCormick, 1993 (part 2), and Harris and Chaney, 1970 (chapters 6-11)

Ergonomical analysis of human-information interaction is helpful (for instance, see Sanders and McCormick, 1993 (part 2) Ergonomical design and analysis of handling and packaging of products should be used Ergonomic techniques can be used to ensure clear understanding of documents, and accessibility of records Ergonomic audits/evaluations, identifying areas for possible improvement of human-machineproduct-environment interactions are performed Ergonomic training should be emphasized Ergonomic characteristics of a product, such as environmental conditions, sensory characteristics proper handling and packaging should be determined (see Bergquist and Abeysekera, 1996; Helander and Burri, 1995; Barsky and Dutta, 1997)

Statistical tools and techniques are used in ergonomic analysis and evaluations 4. 20 Statistical techniques The need for the application of statistical techniques is identified 84 • developing a means of product traceability to facilitate product recall; • considering development of an emergency plan The following section will address some ergonomic factors in the ISO 9001/9004 quality system structure, as well as suggest implementation of this system with ergonomics in mind. 4. Ergonomic considerations of ISO 9001/9004 Quality systems depicted in ISO 9001 and ISO 9004 standards apply to all phases in the life cycle of a service, from initial identification to final satisfaction of customer requirements.

The concept of all activities influencing the quality of a service throughout its life cycle is often referred to as the “service quality loop” (ISO 9004-2, 1994). Thus, a service quality system involves three main elements: (1) service; (2) processes along the quality loop; and (3) resources. Likewise, ergonomic considerations within a service quality system include:

- Ergonomic design and delivery of service (and/or related products).
- Ergonomic design and application of processes.
- Analysis of the interaction between human and information/material resources

Using Figure 1, it is possible to explain how quality and ergonomics interrelate in a quality system. Each product or service made possesses certain characteristics.

For example, service quality is a set of characteristics that bear on the service's ability to satisfy customer requirements. Ergonomic characteristics of products / services provide safe, healthy and efficient usage and/or delivery. It is evident that some ergonomic characteristics of a product (or service) are essentially quality characteristics (such as the design of the driver's seat in a car), and vice-versa. Also, service delivery processes have to satisfy certain requirements that may be ergonomic in nature. For example, the environment in which retail-banking services operate may be altered to provide safety for a bank teller working in it. Finally, ergonomic issues emerge when human, material and information resources are combined to create a quality system.

The current ISO 9001 quality system has a multitude of elements that are directly applicable to managing ergonomics and health/safety. Table I lists all 20 elements of ISO 9001 in the order in which they appear in the standard,

illustrates sections and specific requirements which pertain to ergonomics, and provides ergonomic implications of the quality system. The implications range from adequate identification of customer ergonomic requirements, ergonomically suitable design of products, services and processes, to identification and maintenance of appropriate working environment and equipment.

Such analysis of the ISO 9001 quality system shows that virtually every element of the system includes at least some ergonomic and/or health and safety aspects. This conclusion, however, is not surprising, since ultimately, quality is created by people, and for people. Not only does the content of ISO 9001 relate to human factors (Hansen, 1996), but also its context. A quality system must be adequately documented and implemented in order to operate effectively and efficiently. Quality documentation, as a pillar of the quality system, must be understood and readily available to all persons whose work affects quality, as well as understood by all involved. Ergonomically designed documentation will undoubtedly help people understand their tasks better and improve their performance.

New technologies, such as head-up-displays (Geiselman and Osgood, 1995; Karapetrovic, 1995), computer-aided communication (through electronic mail and the Internet) can greatly improve the implementation of a quality system in any organization. Examples include:

- Operators using HUDs for display of quality procedures and work instructions.
- Paperless ISO 9000 documentation, i. e. documents available on-line using HTML or Java (Clarkin and Dow, 1997).
- Wireless electronic mail for reporting and analysis of quality-related problems.

The following section addresses the

implementation of human factors engineering in services, using financial services as an example, in more detail. 5. Ergonomics and services How do ergonomics relate to service quality systems?

To answer that question, we can follow the above-mentioned “service quality loop” from the inception of the need for service, to the evaluation of whether that need has been satisfied. In designing a “quality service”, we must first identify the need for it, as well as find out who would actually need such a service. Put another way, we are defining the user and his/her needs. For instance, say we want to open a bank branch in a specific location. Do local bank users really need a branch there? What exactly do they need? Perhaps they need investment services, or easy access to cash, or mortgage consultations. Sanders and McCormick (1993) and Bailey (1982) define the identification of user needs through observation, interviews and questionnaires as ergonomic activities that apply here.

Psychology-based tools of ergonomics deal in particular with an effective and efficient determination of user needs. The service system is subsequently designed on the basis of identified needs. We have determined that local users require access to money from their accounts as well as the possibility of discussing investments. Now, we need to allocate resources to required banking functions. These resources include people (bank employees), hardware (automatic teller machines (ATM), computers) and software. Which particular functions should we assign to people, and which to machines? For instance, for easy access to cash, we would assume that a 24hour ATM would be appropriate.

However, what if most of the bank's clients are seniors, who are still not accustomed to trusting machines in dealing with deposits or withdrawals, or if the bank is located in a place where people prefer customer service and contact with bank tellers rather than machines? Ergonomic studies help us in determining specific capabilities of people, hardware and software, and can provide significant assistance in allocating system functions. Then, we can decide whether to completely automate certain functions, or to assign people to perform them, or use both machines and people. For example, a bank may decide to allow withdrawals of less than \$1,000 from an ATM. If a customer wants to withdraw more than that, he/she would have to go to a bank teller. 86

Once we have decided which resources the bank should have (say three ATMs, four tellers and two investment advisors), we need to perform an analysis of the required processes, activities and tasks. Put another way, we are listing the sequence of activities that need to be conducted in order to accomplish a specific function. Flowcharts are particularly helpful here. For instance, we can specify a procedure for cash withdrawals from the bank. This, in ergonomics, is called task description and analysis (Sanders and McCormick, 1993). Whenever we have some interaction between people and hardware or software, such as when a teller needs to input withdrawal information into the database, there are ergonomic implications.

For example, in the bank where I normally do my financial transactions, computer monitors and keyboards are placed so low in relation to the counter, that the teller needs to bend down every time he/she inputs the

information, virtually disappearing behind the counter. Just imagine how many times the teller needs to bend like that every day, every week, every month. Put another way, in designing the work space for employees, e. g. placing customer service counters and computers in determined locations, allocating space for safety deposit boxes, etc. , we inevitably influence the comfort, safety and efficiency of people working in such spaces. All these are ergonomic considerations that can influence the quality of the product or service.

The likely reason why tellers in my bank still have to bend down to reach the computer is that it was probably never defined as a problem at all. The existence of an ergonomic program within the bank, with planned ergonomic audits and corrective actions, would certainly identify and rectify such a problem. But how can such a program be introduced with minimum cost and maximum benefits? Perhaps the solution is in the integration of the existing quality system with an ergonomic program. The integration of quality and environment management systems came naturally, since standards representing best practices were effectively established at the international level (namely ISO 9000 and ISO 14000).

This should also be the case with occupational health and safety (OHS), since national and international OHS standards, dubbed ISO 20000 (Figura, 1996) are already emerging. The following section presents an approach to the development of an ergonomic assurance system on the basis of the quality system.

6. Ergonomics assurance system

As was mentioned in Section 3 of this paper, the systems concept can greatly assist us in understanding the

interrelationships of many production and management processes, among others, quality and ergonomics. For an excellent account of the relationship between ergonomics and the system design, the interested reader can refer to Sanders and McCormick (1993), Chapter 22. While the application of the systems concept to service quality is presented elsewhere (Karapetrovic and Willborn, 1998A), it can be used to propose an ergonomic assurance system. We can define ergonomic assurance as “all those planned and systematic actions aimed at providing confidence to customers, management and the general public, that their requirements and needs for ergonomically safe products and processes are met”.

An ergonomic assurance system is then a “set of processes and resources that function harmoniously to achieve objectives related to ergonomic design and implementation of products and processes”.

Note: Proposed EAS elements are given in bold letters, while numbers represent sections of the ISO 9004-2 Guidelines 87 Similarly to the ISO 14001: 1996 environmental management system, an ergonomic assurance system can include Deming’s plan-do-study-act (PDSA) continuous improvement circle, with the following elements:

- **Ergonomic objectives.**
- **Planning and design** (ergonomic aspects, targets, determination of system performance specifications, ergonomic system design).
- **Resource acquisition and deployment** (allocation of functions to people, hardware and software; task analysis, design of jobs and human-hardware-software interfaces; training).
- **Operation** (ergonomic control, monitoring and measurement).

- Corrective/preventive action (ergonomic audits). Improvement (ergonomic evaluations, communication with interested parties. Interested parties may include customers, for ergonomic characteristics of the product/service, and employees, for ergonomics of the workplace). Rather than adding specific ergonomic and safety requirements to existing quality standards (Barsky and Dutta (1997) suggest this), a separate ergonomic system standard can be drafted, and then integrated with existing quality management systems. Using the definition and the model of a quality system from Karapetrovic and Willborn (1998C), proposed elements of the ergonomic management system (EMS) can be illustrated as in Figure 2.

For example, the executive management of an organization should define an ergonomic policy that is documented and communicated to all employees. Ergonomic aspects of all activities and processes within the organization should be identified and specific objectives and targets set. An ergonomic management program should be defined and documented, and adequate resources allocated. Operation of the EMS should include a statement of responsibility and authority of people involved, identification of training needs and a provision of adequate ergonomic training, and preparation of adequate EMS documentation. Corrective and preventive action to eliminate existing and potential problems should be undertaken, and ergonomic audits would assist in this effort.

Finally, the executive management should review the status of the EMS, including its effectiveness, suitability, and conformance to the requirements.

7. Conclusion This paper addressed some of the ergonomic

issues in the ISO 9000-based quality assurance for services. Outlines of ISO 9001 and ISO 9004 quality system models were provided, followed by a discussion of the content of the ISO 9001 standard considering ergonomics and human factors. Ergonomic implementation of a quality system was subsequently addressed. Finally, possible development of an “ ergonomic assurance system” on the basis of ISO 9001 and systems theory was presented. Further research into the development of ergonomic assurance systems is suggested.