Quality Management of Information Systems

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Abstract

Quality is a decisive influence on any production activity. Appropriate deployment of quality management affects not an only commercial success in the market, but also the company's prosperity. Nowadays, it is one of the basic tools to push ahead in a competitive environment. Quality is a summary of the features and characteristics of a product through which an object acquires the ability to meet the intended and expected needs. Quality does not happen somewhere at the end of production of the product, but it is continuously formed in pre-production, production stages also.

Keywords: *quality; information system; evaluation; criteria.*

1. Introduction

Quality management is an activity that helps deliver the end user service or goods in the expected state. Quality management is a set of multiple activities within an organization, focusing on qualitative indicators within production processes or service delivery processes. It includes interconnected business, technical, economic, personnel, information, tools to ensure a defined quality of the final product (Shamsuddin, Hassan, 2003). Quality must be managed throughout the reproductive process, through company processes and functions that affect the product or service at the end. This fact is suitably shown in the so-called Juran's spiral of quality (Figure 1). The pre-production stages, which are at the very beginning, occupy an important place in this quality spiral. In the past, the emphasis was mainly on the production phase, but current findings confirm the importance of pre-production stages in the quality building – approx. 80 % quality activities in pre-production stages have an influence on final products.

Figure 1. Juan quality helix (Grambličková, 2000)

Successful implementation of quality management should bring the following advantages:

- It helps improve customer satisfaction;
- It increases efficiency in processes with better resource utilization;
- It enables a business to continuously improve their products, processes, and systems;
- It helps an organization achieve greater consistency in tasks and activities that are involved in the production of products.

2. Architecture of information system

The information system is a system consisting of technical, program and people resources and ensures the processing, transmission and collection of information for planning, managing or controlling purposes. The architecture of information systems consists of several subsystems like (Kováč, Šebo, 2013):

- Functional subsystem – Specifies usage of information system. It may be for example data transformation processing, preparation of information for subsequent processing, information archiving, and so on;
- Technology subsystem – It is a technical solution for the information system like a hardware type, its configuration, computing power… etc.;
- Data subsystem – This subsystem act as a data storage device. These can be local disks or network drives depending on the system requirements;
- Network subsystem – A subsystem of network devices to the fulfilling function of connecting the appropriate network components to provide data exchange inside information system or between information systems;
- Software subsystem – It is a program (defined instruction) based on which information system processing information from input to output.

One of the main roles of quality management is quality planning. The target of quality planning is to define the quality of standards and how to reach them. Implementation of management quality is covered by ISO 9000 standards. This issue is standardized under ISO 9000 standards, as shown in Figure 2.

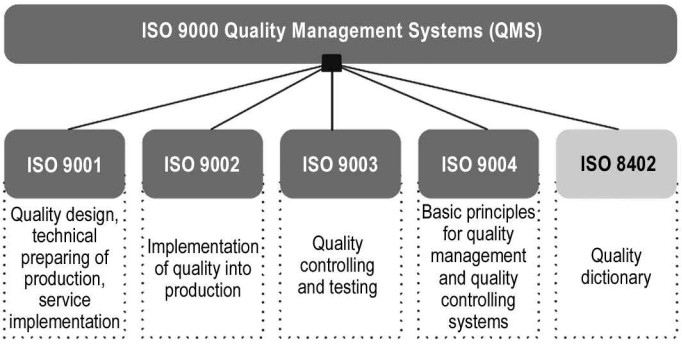

Figure 2. Quality management related to ISO(s)

3. Basic approaches to evaluation of information system quality

When we want to aim at evaluating the quality of information systems that are composed of all of the above-mentioned components, we need to explain two basics quality views on them. Statically view for an understanding of quality based on information system evaluation through a set of quality characteristics. Dynamical view at the quality of information system based on the management of their development processes, because of the essential properties (affect its final quality). Information system quality management including both these concepts and perceives them as a whole (DeLone, McLean, 2016).

The basic ISO standards dealing with quality are (Seddon, Graeser, Willcocks, 2002):

- ISO/IEC 9126-1 – defines the quality of a software product as a set of product characteristics;
- Quality Management (ISO/IEC 2500x);
- Quality Model (ISO/IEC 2501x);
- Quality measurement (ISO/IEC 2502x);
- Quality requirements (ISO/IEC 2503x);
- Quality assessment (ISO/IEC 2504x);
- SquaRE extension (ISO/IEC 25050 – ISO/IEC 25099).

The ISO 9126-1 software quality model identifies six major quality characteristics (it is an extension of McCall's, Boehm & FURPS model) (Seddon, Graeser, Willcocks, 2002):

- Functionality;
- Reliability;
- Usability;
- Efficiency;
- Sustainability;
- Portability.

One of the commonly used methods of quality assessment is the PDCA model, as one of the most widely used approaches focused on the process of continually improving and streamlining the functioning of the system. This model is applicable at all levels and in all areas of business and everyday life (Figure 3).

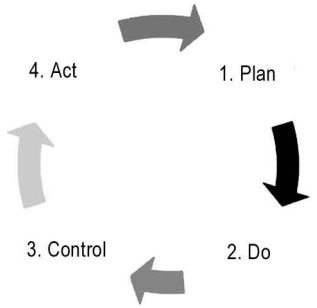

Figure 3. PDCA model
(Guimaraes, Armstrong, Jones, 2009)

The main advantages of improving processes within a company are (Margarido and colleges, 2012):

- Improving planning;
- Increased budget predictability;
- Shortening the development cycle;
- Increase productivity;
- Improved quality as measured by errors;
- Increase customer satisfaction;
- Increase return on investment;
- Lowering the price to achieve the required level of quality.

Another reliable method of evaluating information system is performing an audit which represents the highest level of control. The audit is a complex activity, which includes several independent control mechanisms (formality, complexity, objectivity, independence) with respect to existing standards. The formality of audit means that the audit process must follow the methodology and existing standards. Complexity must be ensured by focusing on all relevant aspects and links. Objectivity is guaranteed by building on existing standards, or based on experience when standards don't exist. Audit independence is indispensable, avoiding possible conflicts of interest, therefore the auditor may not have any connection with the sponsors or the auditing objects (Petkov, 2002).

The most common quality assessment objects in information systems are (Petkov, 2002):

- basic and application software;
- technical equipment;
- telecommunications systems;
- systems development, testing and maintenance processes;
- protection and security of systems;
- data and databases.

Quality and efficiency are interacting and closely related categories, where quality represents a state, while efficiency represents the cycle for dynamics improvements of the system. The quality model represents the product and the goods while the efficiency model represents the paradigm (Garcia and colleges, 2003). At the same time we can include CMMI, COBIT, and ITIL models.

The CMMI model is owned by the Software Engineering Institute (SEI) at Carnegie Mellon University in Pittsburgh and was first published in 1991 as Capability Maturity Model Integration (CMMI). Initially, the usage of this model was evaluating the effectivity of software development processes, and the idea was to believe that better development processes have a direct impact on better software producing. Nowadays, CMM is seen as a widespread standard for measuring the maturity of all processes in the organization, not only in the area of information and communication technologies (ICT) (TNgai, Chau, Poon, 2013).

COBIT is an abbreviation of Control Objectives for Information and Related Technology and is a framework created by the ISACA International IT Governance Association. It divides IT into four domains:

1. planning and organization;
2. acquisition and implementation;
3. delivery and support;
4. monitoring and evaluation.

In total 34 processes are written within these domains. It is a set of practices that should enable the strategic goals of the organization to be achieved through the efficient usage of available resources and minimization of IT risks. It was first published in 1996 and has since been gradually expanded to include audit procedures, implementation tools, detailed goals or management approaches. COBIT 4.1 was published in 2007 and the latest version of COBIT 5 was released in 2012 and is still in use today. It is mainly intended for top managers to assess ICT and for auditors to audit an ICT management system. Unlike the ITIL methodology, which is designed for IT vice-messenger referred to as CIO (De Haes, Van Grembergen, Debreceny, 2013).

ITIL was created as an abbreviation of the Information Technology Infrastructure Library and is a set of proven concepts and practices in practice that enable IT to better plan, use and improve both IT service providers and customers. The project was created in Great Britain in 1985-1995. In the years 2000-2004 it was redesigned to a new version of ITIL V2, which has been used by companies in many countries as a standard for IT service delivery. In 2007 an expanded version of ITIL V3 was created and written into five central books. ITIL V3 describes up to 26 processes. It is a methodology based on the process management of the organization and is intended mainly for middle and senior management as previously mentioned. Today we have available ITIL v5.

At the beginning of selecting an information system, the company management should answer questions about its quality expectations. These expectations should take into account the impact of a possible error on the end users of the system and meet legislative requirements. Important is understanding differences between deploying a non-integration package solution (such as Microsoft Office) and a development customized solution that is integrated with different systems, sometimes outside the organization's infrastructure. Such a system in case of failure should have a fatal impact on human lives (for example air traffic management system). The required characteristics, criteria and cost of quality control for such systems are diametrically different.

4. Criteria for selection of information systems

Selection criteria for current information systems are (Cragg, Caldeira, Ward, 2011):

- Functional – it means that it must serve everything for what was designed.
- Powerful – The system must have a good response, work quickly and display outputs in quality.
- Reliable – must be able to deliver the same results in repeated situations and based on the same inputs.
- Economic – benefit from the system must exceed TCO (total cost of ownership).
- Ergonomic – the system must be user-friendly and as intuitive as possible to operate by user.
- Stable – in critical situations the system must respond appropriately, and data must not be compromised.
- Independent – changes around the system cannot have significant influence or affect its operation
- Scalable – system architecture must be designed to be easily expanded with additional components in the future.
- Safe – security of the system must be ensured in all respects to avoid leakage of sensitive data.
- Operable – the system must be operable in a simple way (managed by the internal user without needs to contact an external partner).
- Properly documented – good technical and user documentation is essential for any system.

At the same time, it is necessary to define how all of these defined attributes will be validated and verified. As part of the validation, we find out whether the information system meets users and management needs. Verification process verifies whether the information system corresponds to the design according to the specification, or that the current legislative requirements are full filled (Kapsodorferova, 2014).

5. Evaluation of information system quality

Information system quality evaluation process can be measured by the number of reported incidents and problems, after a defined time period (for example daily, monthly, quarterly). The evaluation includes also production operation of the information system and quality of the testing process itself. It can also be a summary of feedback from users, administrators and everyone they serve and who work with the system. This feedback not only serves to identify deficiencies, eliminate them but is also linked to the process of continually improving the quality management of information systems within the organization throughout the System Development Life Cycle. The team makes a substantial contribution to providing better IT services within the organization as a whole. When a company is concerned not only about doing savings, inspections, audits, and putting the methodology into practice, but it will also ensure that corrective measures are taken as soon as will be recognized.

TQM system is a different approach than "just" implementing ISO standards. “T” means that the entire organization, all departments and workers must be involved in quality improvement without exception. This is applying to all products and activities of the organization. This is an open system that meets the following features (Lleshi, Lan, 2017):

- Orientation to the wishes, opinions and requirements of the customer;
- Involvement of all business units and all staff;
- Creating a system of "internal" customers;
- Continuous efforts to optimally, efficiently and economically perform all activities comparable to the most advanced competitors – the zero defects principle.

Comprehensive quality management has several accompanying features such as customer satisfaction, improved work results, improved economic results, motivation through qualitative indicators, and everything based on four core pillars (Lleshi, S., Lan, L. (2017):

1) Customer orientation;
2) Planning and leadership;
3) Continuous improvement;
4) Teamwork.

6. Conclusion

Latest management systems such as Total Quality Management and Total Prevention Maintenance, where quality and overall product reliability required minimal maintenance by the user in the future. All quality system is defined as the organizational structure, responsibilities, processes, procedures and resources for implementing quality management.

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