Aspects for Evaluating Acquired Elements of Information Systems

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Abstract: Since developing information systems – be it a whole system or only parts of it – has become uneconomical, the majority of enterprises favours acquiring such systems to developing them from own resources. Purchasing and implementing information systems, however, requires a methodology. One of the most crucial processes within the purchase is choosing the most appropriate system among those available on the market. This paper offers a system of aspects which helps senior managers of a company evaluate various systems or parts of them all serving the same purpose. The listed aspects provide a possible list of aspects to help evaluate information systems available objectively by applying a set of carefully set weighting factors to well defined characteristics. The listed aspects all account for valid standards and recommendations.

1 Introduction

Producing and service provider businesses usually do not develop their informatics solutions unaided on their own. This is especially true for the integrated resource design and business management information systems, which can serve the basis for further informatics developments (e-business, business intelligence applications, workflow). In any case of purchase or implementation it is a serious task to evaluate and compare the offers from both technical and economic points of view. This is also true for the commercial commodity elements of information systems supported by services.

What the organizations are looking for is not a software package and hardware but a tool which is able to support certain areas of organizational operation appropriately.
Standards and recommendations dealing with quality management, security of information technology and information system audit can be helpful in defining the requirements.

2 Recommendations and Standards Used

ISO 7498
Information processing systems - open systems interconnection, basic references model
- 1: The basic model
- 2: Security architecture
- 3: Naming and addressing
- 4: Management framework

ISO 9000-3
Quality management and quality assurance standards Part 3: Guidelines for the application of ISO 9001 to the development, supply and maintenance of software

ISO/IEC 9126
Information technology; software product evaluation; quality characteristics and guidelines for their use
- 1: General overview
- 2: Planning and management
- 3: Process for developers
- 4: Process for acquirers
- 5: Process for evaluators

ISO/IEC 15408 (Common Criteria)
Information technology Security techniques Evaluation criteria for IT-security
- 1: Introduction and general model
- 2: Security functional requirements
- 3: Security assurance requirements
ISO/IEC 17799
Information technology Code of practice for information security management

ISO/IEC 27001 (BS 7799-2)
Information security management – System Requirements
(Originally it was the second part of the previous standard, on the basis of which the formed information security management system can be audited.)

ISO 9241
Ergonomic requirements for office work with visual display terminals
(The following list is not complete.)

- 1: General introduction
- 4: Keyboard requirements
- 5: Workstation layout and postural requirements
- 6: Guidance on the work environment
- 8: Requirements for displayed colours
- 9: Requirements for non-keyboard input devices
- 10: Dialogue principles
- 12: Presentation of information
- 14: Menu dialogues
- 15: Command dialogues
- etc.

AQAP-110 [3]
NATO Quality Assurance Requirements for Design, Development and Production

AQAP-150
NATO Quality Assurance Requirements for Software Development
(This standard is only valid together with AQAP-110 and ISO/IEC 9126)

AQAP-159
Guidance for the use of AQAP-150

AQAP-160
NATO integrated quality requirements for software throughout its life cycle
(The standard is based on two civil standards, the ISO/IEC 12207 and the ISO 9001)

**AQAP 169**

NATO Guidance on the use of AQAP-160

(Overview on the adaptation of civil standards)

**ISO/IEC 12207**

Information technology – Software life cycle processes

**COBIT**

(Control Objectives for Information and related Technology by Information Systems Audit and Control Foundation and IT Governance Institute, USA) [4]

- Executive Summary
- Implementation Tool Set (Executive Overview, Case Studies, Implementation Guide etc.)
- Framework with High-Level Control Objectives
  - Management Guidelines (Maturity Models, Critical Success Factors, Key Goal Indicators, Key Performance Indicators)
  - Detailed Control Objectives
  - Audit Guidelines

**ITIL**

(Information Technology Infrastructure Library by Central Computer and Telecommunication Agency, Great Britain) [1,2]

Collection of practical methodologies for improving the operation of information infrastructure. ITIL is the consistent and comprehensive documentation of best practice for IT Service Management.

**Euromethod**

A methodology dealing with obtaining, improving and adapting information systems. [5,6]

Framework what can be used by both the customer organisation and the supplier organisation in any project regarding an information system:

- Overview
- Customer Guide
- Supplier Guide
- Delivery Planning Guide
3 Guidelines for the Evaluation of Information System Elements

Setting up the set of evaluating factors and aspects that build the basis for the final decision is not only the task of experts of informatics since in the case of any offered solution the services that go with it, the measure of correspondence with the processes within the company and economic aspects have to be evaluated, too. The result is usually a large amount of evaluating factors, which are determined by some appropriate technique related to brainstorming. In this paper we do not deal with these in detail.

A basic requirement is that the circle of alternatives be complete, that is none of the important factors be left out.

Overlapping between the aspects may hamper the evaluation and make result ambiguous. There may be aspects corroborating or contradicting each other. This fact can be demonstrated with the example of evaluation factors taken over from software-quality-models:

- the simplicity of a software originating in testability and maintainability may to a certain degree support easy learning for users,
- but the software-independence of an open information system may be in opposition to its access regulability.

The evaluation guidelines, introduced here, do not contain special professional expectations. These can be defined precisely only after getting to know the concrete purchase (e.g. the kind of stockpiling models a warehouse-management system should require …). On the second level of the guideline-hierarchy the needed and utilized standards and recommendations are determined. These documents in some cases regulate the same areas from different points of views. It is common in almost all levels to try to correct the operation and security of an already existing information system. The question to ask is why the stated professional experiences should not be taken into consideration in the planning phase prior to implementation?
In case of a large number of factors, aspects may form a hierarchy or may be grouped. The list below is a subjective example for ERP systems:

A  **User and operator demands made on the IT product**


- Suitability for the organizational process, requirement and specification
- Data and program accuracy
- Compliance to standards and legal regulation
- Possibility for improvement independent from the supplier

A.2  **Usability (ISO/IEC 9126, ISO/IEC 15408-3, ITIL, COBIT, ISO 9241-x)**

- Ergonomics (e.g. user-friendly, integral operator interface)
- Learnability
- Operability (easy to understand error messages, easy and secure data input, easy to handle menus etc.)
- Quality of user documentation
- Devoid of redundancy (both with data and process elements)

A.3  **Openness, ability for cooperation (COBIT, ITIL, ISO 7498)**

- Operation system
- Database management
- Communication skill, interoperability (handling standard data formats, logical and physical data independency)
- Adjustability to existing hardware and software systems

A.4  **Reliability (ISO/IEC 9126, ISO/IEC 17799, ITIL)**

- Fault tolerance
- Recoverability (complexity of restarting the system, time needed)
- Fault occurrence (e.g. expected time interval between the occurrences of two mistakes)
- Availability (e.g. in how many percent of the server’s operation available is it interval)


- Source and time needed for fault correction or alteration
• Testability
• Adaptability
• Installation (independency from hardware and software environment, possibilities for reuse, etc.)
• Replaceability
• Maintenance, needed resource and the time for saving
• Quality of system documentation

A.6 Efficiency (ISO/IEC 9126, ISO 7498)
• Speed of data processing (e.g. feedback interval)
• Resource harnessing (equal load of hardware elements)
• Capacity data (e.g. memory size, hard disk-storage capacity, transmission of data per second)
• Modernity and practicability of the applied hardware and software solutions

A.7 Security and integrity (ISO/IEC 14598, ISO/IEC 15408-2, ISO/IEC 17799, ITIL, COBIT)
• Controllability of information transfer and origin (logging)
• Defence against unauthorized users (environmental and physical security)
• Cryptographic control
• Defence against break in the communication channel and data loss, malfunctions
• User, operator identification and authentication

B Financial guidelines
B.1 Prices (COBIT, ISO/IEC 12207)
• System planning and adapting (introduction, system integration)
• Hardware (server, terminals, network)
• Software (operation system, database management, application)
• Other relevant service (education and training)

B.2 Payment conditions (COBIT)
• Deadline for payment
• Penalty payment in case of delay or non-performance
• Validity of proposed price
• Discounts
• Payment schedule
• Measure of periodical price increase

B.3 Costs (COBIT)
• Rental fees
• Maintenance (follow-up fees for both hardware and software)
• Consultation and support
• Operating the information system
• Proof of cost savings arising from applying the new system

C Evaluation of the Supplier and the services
C.1 General judgement of the supplier (ISO 9000-3, AQAP-110, AQAP-150)
• References
• Existence of audited quality-control and security systems
• Use of approved development method (e.g. SSADM)
• The willingness for cooperation
• Membership in professional association of IT companies
• Composition of employed professionals and subcontractors, professional experience
• Financial data (result after-tax and its changes, sum of balance, size of capital)
• Capacity of supplier and his other orders during the same period

C.2 Undertake of the supplier, related services (ISO/IEC 12207, AQAP-160, AQAP-169, COBIT, Euromethod)
• Deadline for delivery
• Undertakings connected with guarantee, warrantee and responsibility
• Using and accepting project methodology of introduction
• Training and education
• Loading and creating database
Providing a test file for getting to know the system
Deadline for implementation

C.3 Services provided following implementation (COBIT, ITIL)
- Software release management
- Troubleshooting
- Serving subsequent, unique needs
- Advisory functions and user guide
- Repair service (availability, accessibility, standard of level)
- Deadlines for supplying spare parts
- The willingness for cooperation in change management (new versions, passing on and introducing equipment and knowledge)

Summary
The standards and recommendations used in this article all deal with the improvement of security, quality control, and auditing of already operating information systems. The documents are independent from information technology and software (programming language, operational system, database management). The evaluation system formed, in case of a given task, can be supplemented with further levels and concrete technical requirements. This is essential, since the standards and recommendations change and increase continuously. The documents can be accessed by everyone even via the Internet (e.g. AQAP, COBIT). Investigation of the documents has not been made full-scale. There are several recommendations, standards and methodologies, which can serve as a basis for qualifying the information solutions (e.g. SPICE, BOOTSTRAP, TickIT, TCSEC, ITSEC).

References
[3] www.nato.int/docu/standard.htm#AQAP