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INFORMATION PROJECTS QUALITY MODEL

Ran Bergmann[1]*

Corresponding Author:
Email: bergman.rani@gmail.com

Abstract:-

The requirement to establish a quality model has been felt by users for the purpose of evaluating the software quality quantitatively and qualitatively [1].
Information quality literature has provided a great amount of proposals for assessing the quality of information, but there is still a need to develop frameworks for assessing and improving the quality of information from the information consumer and the organizational point of view in the perspective of the information project classification. Moreover, for each dimension there must be set a clear definition what it represents, in order to be able to compare it for any type of Information Project (i.e. Information System) throughout its life cycle [2].
In order to improve the quality of information projects, it is required to present an information project quality improvement model that can be iterative measured and improved, during a period of time. Quality improvement is an iterative process that requires planning, execution, checks and feedback from the information consumers (IS users) in the organization. By this process, during a certain time frame, the quality of the project can be improved and reach higher business performances. Therefore, the quality activities are performed on a time scale, all along with the project's life cycle, in order to achieve an effective improvement of the project quality.

Keywords:- *Information Quality, Information Projects, Information Systems, Project Management, Quality Management*

Information Project Management Domain

Mapping the literature of information management:

In order to cope with the voluminous literature on information management, a bibliometric study was performed [3]. By means of an author co-citation analysis of data from Science Citation Index and Social Science Citation Index, the intellectual structure of information management was mapped (See Figure 1) [4].

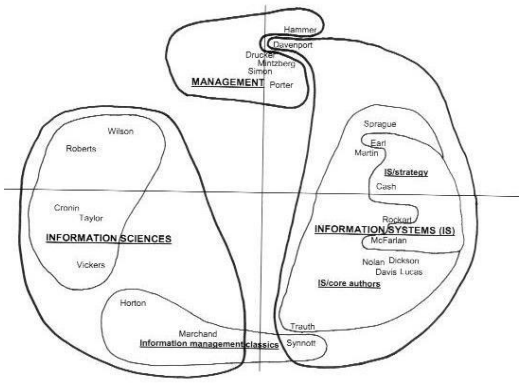


Figure 1: Map of information management (source: Schlögl 2003)

Project Management Diamond:

Projects need to be performed and delivered under certain constraints. One of the most popular sets of constraints often used illustrates that project management success is measured by the project team's ability to manage the project so that the expected results are produced while managing time and cost. These are typically referred to as the "Project Management Triple Constraint" or "Project Management Triangle" (See Figure 2).

Each side of the triangle represents a constraint, whereby one side cannot be changed without affecting the others. The three vertices are called "Scope", "Time" and "Cost". In the middle of the triangle is a fourth constraint called "Quality", which sits as the central theme.

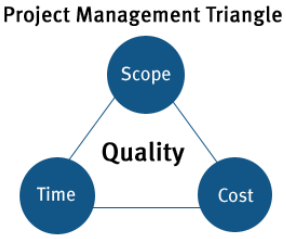


Figure 2: The Project Management Triangle

As Project Management evolves into industry specialization, so does the triangle. At Eze Castle Integration, for example, the demanding needs of financial vertical clients are such that the typical triangle has given way to a Project Management Diamond, with Time, Cost, Scope and Quality the four vertices and Customer Expectations as a central theme (See Figure 3) [5].

Figure 3: The Project Management Diamond

Why do IT Projects Fail?

The Standish Group collects information on project failures in the IT industry and environments with the objective of making the industry more successful and to show ways to improve its success rates and increase the value of the IT investments. According to CHAOS reports published by the Standish Group, we can observe some improvement in

managing successfully software projects during last decade but it is still remain important issue to be addressed when undertaking software development type projects. As given in the Table 1 below according to CHAOS reports, the failure rate of IT projects has increased compared to the success rate of such projects [6] [7] [8] [9].

Table 1: CHAOS Report Results for years 2002 to 2012 [8] [9]

Years	2002	2004	2006	2008	2010	2012
Successful	34%	29%	35%	32%	37%	39%
Challenged	51%	53%	46%	44%	42%	43%
Failed	15%	18%	19%	24%	21%	18%

The Bull Survey (1998), reveals that the major causes of project failure during the lifecycle of the project are a breakdown in communications (57%), a lack of planning (39%) and poor quality control (35%) [10] (See Figure 4).

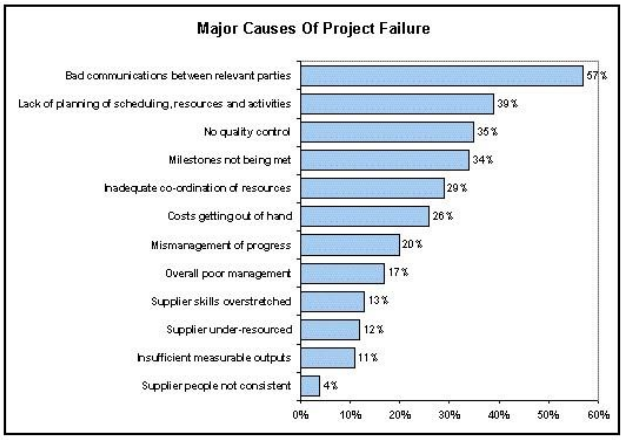


Figure 4: Major Causes of Project Failure (Bull Survey, 1998)

In order for a project to be classified as successful, it must satisfy three criteria: its outputs must be of the agreed **quality**, they must be delivered in the agreed **timescale**, and they must be delivered at the agreed **price** [11].

IT projects have a bad quality reputation

IT projects have a bad reputation for going over budget and schedule, not realizing expectations and for providing poor return on investment. Surveys and reports on the acceptability of new IT systems seem to highlight constantly the same problems and probable causes of failure yet businesses, large and small, continue to make mistakes when attempting to improve information systems and often invest in inappropriate or unworkable changes without proper consideration of the likely risks [12].

Information Management and Common Problems

Organizations are confronted with many information management problems and issues. In many ways, the growth of electronic information (rather than paper) has only worsened these issues over the last decade or two [13].
Common information management problems include:

- Large number of disparate information management systems.
- Little integration or coordination between information systems.
- Range of legacy systems requiring upgrading or replacement.
- Direct competition between information management systems.
- No clear strategic direction for the overall technology environment.
- Limited and patchy adoption of existing information systems by staff.
- Poor quality of information, including lack of consistency, duplication, and out-of-date information.
- Little recognition and support of information management by senior management.
- Limited resources for deploying, managing or improving information systems.
- Lack of enterprise-wide definitions for information types and values (no corporate-wide taxonomy).
- Large number of diverse business needs and issues to be addressed.
- Lack of clarity around broader organizational strategies and directions.

- Difficulties in changing working practices and processes of staff.
- Internal politics impacting on the ability to coordinate activities enterprisewide.

5 Level Pyramid Model Diagram - Information Systems Types

Five level pyramid model based on the processing requirement of different levels in the organization (See Figure 5) [14]:

- The first level represents transaction processing systems to process basic data.
- The second level represents office support systems to process information in office.
- The third level represents management information systems to process information by managers.
- The fourth level represents decision support systems to process explicit knowledge.
- The fifth level represents executive information systems to process tacit knowledge.

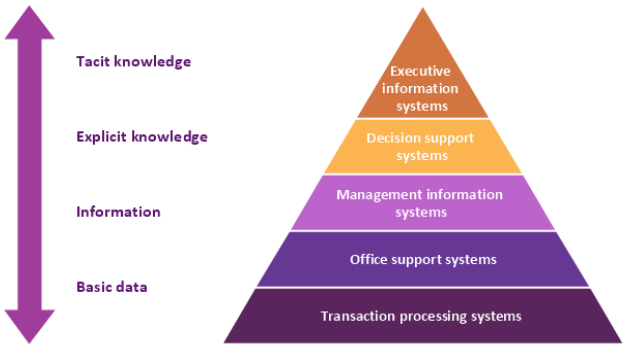


Figure 5: 5 Level pyramid model diagram - Information systems types

The Verification Paradox

Some Projects Unable to Quantify Process Effectiveness [15] (Peter Drucker):

- What gets measured, gets done
- What gets measured, gets improved
- What gets measured, gets managed

Different Purposes Require Different Measures [16].

What are Metrics?

Quality metric is a metric that quantifies a quality criterion and thus makes it measurable, objective, and unambiguous. A quality metric is a way of measuring that quantifies a quality criterion. Quality metrics thus provide numerical values specifying or estimating the quality of a work product or process by measuring the degree to which it possesses a specific quality factor or sub-factor [17].
Quality metric using to [15]:

- Measurements that provide visibility into a process
- Help identify issues so corrective action can taken
- Historical trend data facilitates future project planning

What is a Quality Model?

A quality model is a model that models the quality of something. The role of the quality model is to make the general term "quality" specific and useful by decomposing it into its component concepts and their relationships to one another. A quality model first decomposes quality into its component quality factors (i.e., characteristics) and sub-factors (i.e., parts). It then provides specific quality criteria (descriptions) and metrics (means of measurement) that can be used to turn these general high-level quality factors into detailed and specific measurable descriptions that can be used to specify an aspect of quality or to determine if that aspect of quality actually exists at a level equal or above the minimum amount specified in a requirements specification [17].

Evaluate Software Quality

Quality is the total of features and characteristics of a product or a service that bears on its ability to satisfy the given needs (ANSI/ASQC A3/1978). Software quality plays an important role in success of the overall software system. So it is considered as a very important aspect for the developers, users and project managers. Software quality is the extent to which an industry-defined set of desirable features are incorporated into a product so as to enhance its lifetime performance [1]. In order to evaluate software it is necessary to select relevant quality characteristics. This can be done using a quality model which breaks software quality down into different characteristics [18].

To evaluate software quality a quality model should be defined [19]!

ISO 9126 Software Quality Model

There are many quality models of varying degrees of completeness and usability. Some are international standards (i.e., ISO), some are de facto industry standards, some are organization specific and some are published in software engineering books [17]. The quality models which are present nowadays are most hierarchical models based on quality criteria and associated metrics [1].

ISO/IEC 9126 is the international standard for software quality that has been agreed upon by a majority of the international community and upon which some countries, such as Japan, have decided to standardize .It defines a common language relating to software product quality and is widely recognized as such, at least in Europe, where a survey indicates that it is known by at least 70 percent of the IT community [20] [21]. The ISO 9126 software quality model (See Figure 6) identifies 6 main quality characteristics, namely [22] [23] [24]:

- Functionality
- Reliability
- Usability
- Efficiency
- Maintainability
- Portability

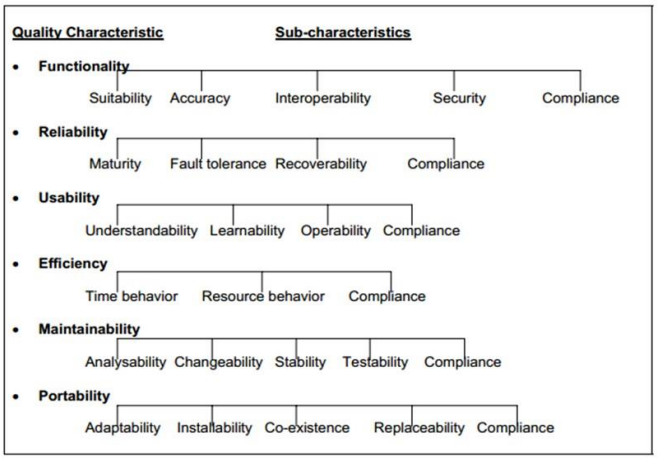


Figure 6: Sub-characteristics of ISO 9126-1 Quality Model

Comparison of Quality Models

Different software quality models were proposed for software applications by various researchers, the table (Table 2) represent the Comparison of quality models [1].

Table 2: Comparison of quality models [1]

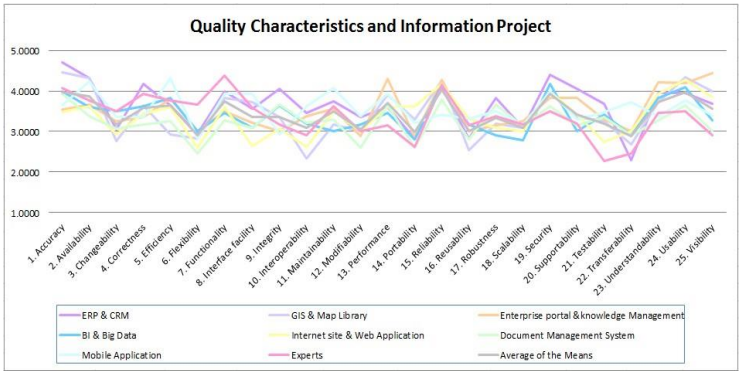
Quality Characteristic	Mc Call	Boehm	FURPS	Ghezzi et al.	IEEE	Dromey	ISO9126-1	Kazman	Khosravi K .et al	Sharma A. et al	Kumar et al.	Sum
Accuracy				X								1
Availability/ Reliability	X	X	X	X	X	X	X	X		X		9
Correctness	X											1
Efficiency	X	X	X		X	X	X	X		X	X	9
Flexibility	X			X				X	X			4
Functionality			X		X	X	X	X		X	X	7
Human Engineering		X										1
Integrity				X								1
Interoperability	X											1
Maintainability	X	X	X	X	X	X	X	X		X	X	10
Modifiability		X										1
Performance			X			X						2
Portability	X	X		X	X	X	X			X		7
Process Maturity						X						1
Reusability	X			X		X			X			4
Robustness									X			1
Scalability									X			1
Security	X							X				2
Supportability			X									1
Testability	X	X						X				3
Understandability		X	X									2
Usability	X		X	X	X	X	X	X	X	X	X	10
Sum	11	8	8	8	6	9	6	8	5	6	4	

Survey Results of the Quality Characteristics versus Types of Information Projects
The table (Table 3) shows a summary of the averages for each quality characteristic for each of seven types of information projects and experts as a control group, with the average of the means (value from 1 to 5):

Table 3: Survey results, Average of the Groups and average of the Means

Characteristics	ERP & CRM	GIS & Map Library	Enterprise Portal & Knowledge Management	BI & Big Data	Internet Sites & Web Application	Document Management System	Mobile Application	Experts	Average of the Means
1. Accuracy	4.7143	4.4667	3.5385	4.0000	3.4706	3.9286	3.6471	4.0769	3.9803
2. Availability	4.3182	4.3077	3.6667	3.6000	3.6250	3.3846	4.2353	3.7692	3.8633
3. Changeability	3.0455	2.7692	3.2500	3.5000	2.9375	3.0769	3.3529	3.5000	3.1790
4. Correctness	4.1818	3.6429	3.3636	3.6154	3.4375	3.1818	3.3529	3.9231	3.5874
5. Efficiency	3.6364	2.9231	3.8000	3.8333	3.6000	3.2500	4.3125	3.7692	3.6406
6. Flexibility	2.9565	2.8333	3.0000	3.0000	2.6000	2.4545	2.8235	3.6667	2.9168
7. Functionality	4.0000	3.8333	3.5000	3.4545	3.6000	3.2727	3.9375	4.3846	3.7478
8. Interface facility	3.5652	3.7273	3.2222	3.0833	2.6429	3.1000	3.9333	3.5833	3.3572
9. Integrity	4.0435	3.3636	3.0000	3.6364	3.0714	3.6667	2.9231	3.1818	3.3608
10. Interoperability	3.4545	2.3333	3.3750	3.2000	2.6154	3.2222	3.6154	2.9091	3.0906
11. Maintainability	3.7391	3.1667	3.5556	3.0000	3.5000	3.3000	4.0714	3.6154	3.4935
12. Modifiability	3.3636	3.0000	2.8889	3.1818	3.0000	2.6000	3.3846	3.0000	3.0524
13. Performance	3.6087	3.9091	4.3000	3.4545	3.6000	3.6364	3.9333	3.1538	3.6995
14. Portability	2.8261	3.3000	2.8750	2.8000	3.6154	2.6000	3.2143	2.6154	2.9808
15. Reliability	4.0870	4.2500	4.2857	4.1818	4.1667	3.7778	3.4286	4.1538	4.0414
16. Reusability	2.8182	2.5455	3.0000	3.1818	3.3077	2.8000	3.3077	3.1538	3.0143
17. Robustness	3.8182	3.2000	3.1429	2.9000	3.0833	3.6667	3.5000	3.3846	3.3370
18. Scalability	3.0909	3.1000	3.2500	2.7778	3.0000	3.1250	3.1538	3.1667	3.0830
19. Security	4.4091	4.0000	3.8182	4.1667	4.0000	3.6154	4.0000	3.5000	3.9387
20. Supportability	4.0435	3.3571	3.8333	3.0000	3.4118	3.1429	3.2941	3.2000	3.4103
21. Testability	3.6818	3.2500	3.3000	3.4167	2.7500	3.3636	3.4706	2.2727	3.1882
22. Transferability	2.3043	2.6923	3.0000	2.9167	3.0000	2.9167	3.7333	2.4545	2.8772
23. Understandability	3.9500	3.7273	4.2222	3.8182	3.9333	3.2727	3.3750	3.4545	3.7192
24. Usability	3.9545	4.3333	4.2000	4.0909	4.2667	3.6364	3.7647	3.5000	3.9683
25. Visibility	3.6818	4.0000	4.4444	3.2727	3.8571	3.0000	3.4000	2.9167	3.5716

Quality Characteristics and Information Projects
The graph (See graph 1), represent the average of each quality characteristic related to Information Projects types, According the data from the table before (Table 3):



Graph 1: Quality Characteristics and Information Projects

Information Quality Assessment
Information quality (IQ) has become a critical concern of organizations and an active area of Management Information Systems (MIS) research. The growth of data warehouses and the direct access of information from various sources by managers and information users have increased the need for, and awareness of, high quality information in organizations. MIS researchers have always considered the quality of information to be important [25].
Information quality assessment is the process of evaluating if a piece of information meets the information consumer's needs in a specific situation [26, 27]. Information quality assessment involves measuring the quality dimensions that are relevant to the information consumer and comparing the resulting scores with the information consumer's quality requirements [28].
The assessment of IQ is a key determinant of IQ management, as one cannot manage IQ without measuring it appropriately [29] [30].

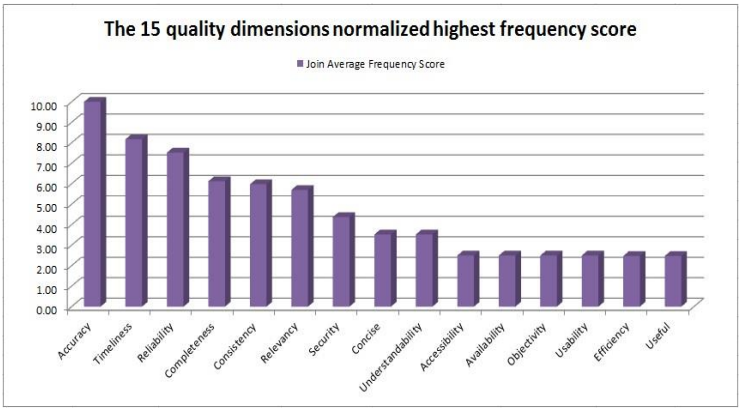
Quality Dimensions and the Frequency Score
Based on the comprehensive literature review - summarize the most often cited data and information quality dimensions as shown in Table 4 [2]:

Table 4: Quality dimensions and the frequency score

Quality dimensions	Frequency score	Quality dimensions	Frequency score	Quality dimensions	Frequency score
Accuracy	10	Usability	2.50	Interpretability	0.80
Timeliness	8.18	Efficiency	2.48	Content	0.60
Reliability	7.53	Useful	2.48	Importance	0.60
Completeness	6.13	Amount of data	1.88	Sufficiency	0.60
Consistency	5.98	Believability	1.88	Usableness	0.60
Relevancy	5.70	Navigation	1.88	Clarity	0.40
Security	4.38	Reputation	1.88	Comparability	0.40
Concise	3.53	Value-Added	1.88	Freedom from bias	0.40
Understandability	3.53	Currency	1.80	Informativeness	0.40
Accessibility	2.50	Flexibility	1.00	Level of detail	0.40
Availability	2.50	Precision	1.00	Quantitativeness	0.40
Objectivity	2.50	Format	0.80	Scope	0.40

Quality Dimension Normalized Highest Frequency Score

The graph (See graph 2), represents the quality dimensions and the frequency- the most often cited data and information quality dimensions based on the comprehensive literature review



Graph 2: The 15 quality dimension normalized highest frequency score

Propose a Model for Improving Information Project Quality

In order to improve the quality of information projects, it is required to present an information project quality improvement model that can be iterative measured and improved, during a period of time. Quality improvement is an iterative process that requires planning, execution, checks and feedback from the information consumers (IS users) in the organization. By this process, during a certain time frame, the quality of the project can be improved and reach higher business performances.

Therefore, the quality activities are performed on a time scale, all along with the project's life cycle, in order to achieve an effective improvement of the project quality. During each activity, the quality measurements' results will be tested and further recommendations for improvements will be given, by feedback and controlling. This type of process will enable to compare, along time periods on the time scale, the quality improvement from iteration to iteration and produce a quality improvement scale for that period.

Since that information project owns unique characteristics and specific quality measurements; they are the core parameters of the proposed model.

The main relevant parameters that take part in the model are:

1. Project classification, such as, information project type (CRM, ERP, BI, etc.), end users quantity, information volume, budget, project content, etc.
2. Information quality dimension required according to the decisions making type and the information needs within the organization.
3. Information system quality characteristics that describe the software platform quality that contains the infrastructure of the information project.

During the progress of the project, the quality activities will be carried out according to the quality measurement scale and the input parameters that were set in advance. As well as the user's feedback on the information system quality, this will be used as additional quality parameters for quality improvement in the model. As a result of the quality activities, the project quality will be improved, that will lead to a higher user experience and higher performances. The end user of the information system, will feedback the received quality and those will be a return parameters used for quality improvement during the next interactions (namely, the next quality activities). It will be possible to plan the next quality activity, according to the redetermined parameters and according to the end users feedbacks that were received from the previous activity. After completing additional quality activities, we expect that the project quality will be improved, a thing that can be measured and compared to the quality index bar of the whole project quality (namely, quality measurement scale). A re-feedback will be executed by the end users, expecting that the quality will raise the project performance and satisfaction. These improvement activities will bring to higher performance of the information system and the end users, which will impact the business activities in the organization information technologies area. It is needed to set the required quality level that needs to be accomplished, in order to plan the budgets for the quality activities, in order to reach the desired goal. Hereby find attached a model illustration, which describes the quality activities results, the parameters and the quality improvement along the time scale (the project life cycle: from the initiation phase till to the closing phase). See Figure 7 Improving Information Project Quality Model.

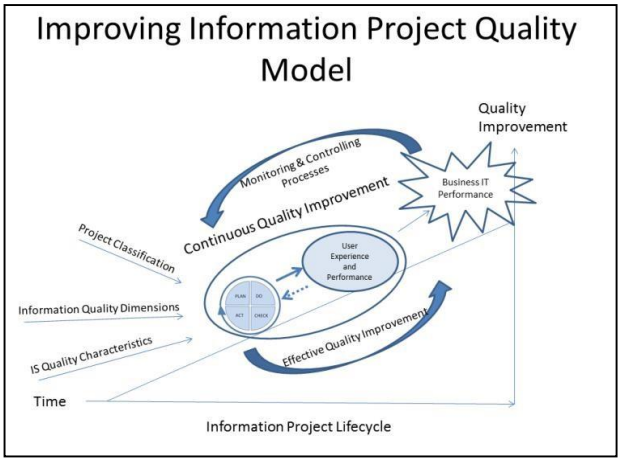


Figure 7: Improving Information Project Quality Model

Conclusions

Since an information project is a private case of a certain information system foundation (regarding: time frame, budget, contents and quality requirements), to achieve a certain business improvement (ROI), it is required to determine, for each project, its own relevant quality measurement scale, according to the information project type and the information needs. Therefore it is needed to understand the type of information managed and the information system, in order to determine the suitable quality characteristics and their importance. In addition it is important to get the feedback from the information consumer to enable continuous quality improvement throughout the project life time and according to their needs.

The quality activities should be carried out in an iterative way of measurement and improvement, it is required to propose a quality model that, on the one hand, gets the suitable parameters that fit an information project and, on the other hand, allows to measure, in a unified scale, the quality improvement results, along with the project life cycle.

References:

[1]. Sanjay Kumar Dubey SG, Prof. (Dr.) Ajay Rana. Comparison of Software Quality Models: An Analytical Approach. *International Journal of Emerging Technology and Advanced Engineering* 2012, **2**.

[2]. Ran B. Quantifying Information Quality. *Studia Universitatis Moldaviae* 2015, **7:86**-97.

[3]. Schlögl C. Wissenschaftslandkarte Informations management. *Wirtschaftsinformatik* 2003, **45:7**-16.

[4]. Schlögl C. Information and knowledge management: dimensions and approaches. *Information Research* 2005, **10**.

[5]. Gianniris D. The Eze Castle Project Management Diamond. In: *Hedge IT Blog*; 2010.

[6]. Dominguez J. The Curious Case of the CHAOS Report 2009. 2009.

[7]. Champa Hewagamage KPH. Redesigned Framework and Approach for IT Project Management. *International Journal of Software Engineering and Its Applications* 2011, **5:89**-106.

[8]. International SG. CHAOS Manifesto 2012. 2012.

[9]. International SG. CHAOS Manifesto 2013. 2013.

[10]. Bull. Failure Causes Statistics - The Bull Survey (1998). In. Edited by Cortex I; 1998.

[11]. Wilson D. Software project failure rates. In: *Musings on software engineering etc.*; 2014.

[12]. Bronte-Stewart M. Risk Estimation from Technology Project Failure. *4th European Conference on Management of Technology* 2009.

[13]. Robertson J. 10 principles of effective information management. In: Step Two; 2005.
[14]. http://conceptdraw.com/. 5 Level pyramid model diagram - Information systems types. In. Edited by ConceptDraw.
[15]. Foster H. From Paradox to Paradise. In: *Evolving SoC Functional Verification Capabilities*: Mentor Graphics Corp.; 2012.
[16]. Behn RD. Why Measure Performance? Different Purposes Require Different Measures. *Public Administration Review* 2003, **63:586**-606.
[17]. Firesmith DG. Common Concepts Underlying Safety, Security, and Survivability Engineering *Carnegie Mellon University* 2003, **Technical Note CMU/SEI-2003-TN-033**.
[18]. Bevan N. Quality and usability: A new framework. *Van Veenendaal, E, and McMullan, J (Eds) Achieving software product quality* 1997.
[19]. Patrik Berander L-OD, Jeanette Eriksson, Tony Gorschek, Kennet Henningsson, Per Jönsson, Simon Kågström, Drazen Milicic, Frans Mårtensson, Kari Rönkkö, Piotr Tomaszewski. Software quality attributes and trade-offs. *Blekinge Institute of Technology* 2005.
[20]. G. Bazzana OA, T. Jokela. ISO 9126 and ISO 9000: friends or foes? *Software Engineering Standards Symposium* 1993:79-88.
[21]. MARC-ALEXIS CÔTÉ WS, ROBERT A. MARTIN, CLAUDE Y. LAPORTE. Evolving a Corporate Software Quality Assessment Exercise: A Migration Path to ISO/IEC 9126. *SOFTWARE QUALITY PROFESSIONAL* 2004, **6:4**-17.
[22]. Sqa.net. An overview of the ISO 9126-1 software quality model definition, with an explanation of the major characteristics. In: *ISO 9126 Software Quality Characteristics*: http://www.sqa.net/.
[23]. ISO. Information technology - Software product quality. In: *Part 1: Quality model*: ISO/IEC; 2000.
[24]. Francisca Losavio LC, Nicole Lévy, Amar Ramdane-Cherif. Quality Characteristics for Software Architecture. *JOURNAL OF OBJECT TECHNOLOGY* 2003, **2:133**-150.
[25]. Yang W. Lee DMS, Beverly K. Kahn, Richard Y. Wang. AIMQ: A Methodology for Information Quality Assessment *Information & Management* 2002, **40:133**-146.
[26]. Felix N. *Quality-Driven Query Answering for Integrated Information Systems*: Springer-Verlag Berlin Heidelberg; 2002.
[27]. Leo L. Pipino YWL, Richard Y. Wang. Data Quality Assessment. *Communications of the ACM* 2002, **45:211**-218.
[28]. Bizer C. Quality-Driven Information Filtering in the Context of Web-Based Information Systems: Freie Universitat Berlin; 2007.
[29]. Besiki Stvilia LG, Michael B. Twidale, and Linda C. Smith. A Framework for Information Quality Assessment. *JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE AND TECHNOLOGY* 2007, **58:1720**–1733.
[30]. Ge Mouzhi HM, Jannach Dietmar. INFORMATION QUALITY ASSESSMENT: VALIDATING MEASUREMENT DIMENSIONS AND PROCESSES. *ECIS 2011 Proceedings* 2011.