

The Macrotheme Review

A multidisciplinary journal of global macro trends

Trends in Document Management System towards the Usage of Cloud Computing

Harald Steffen and Zuzana Papulová

Comenius University in Bratislava, Faculty of Management, Bratislava

Abstract

The aim of this paper is to study and to examine the applicability of cloud computing for the storage of corporate documents resulted from quality management. The international standard ISO 9001:2015 with its "high level structure" calls in many passages for "documented information" that must be created, maintained, stored, kept safe and available. To attain it, an external reliable backup and archiving storage is in addition to the use of a document management system. The document management system manages the handling of the data; the memory system only ensures a reliable global storage. In this connection, companies are nowadays interested in usage of cloud computing. For this reason, a survey among companies in the manufacturing industry was established and carried out. We collected the data using questionnaires and analyzed approaches to document management and usage of cloud computing. The evaluation of data determines the degree of importance of conformity and legal regulations and the way of thinking about cloud computing, possible security concerns and potential for improvement. The results point out the popularity but also the level of the risks of cloud computing and helps to represent the current opinion about cloud computing.

Keywords: Document Management System, ISO 9001:2015, Cloud Computing

1. Introduction

Development of information and communication technologies is subjected to trends that should be considered and also reflected. Development of web services, as software as a service or cloud computing, development of mobile devices as well as mobile internet, and the development of modern formats for distributing web content, are just some of the trends that are influencing our everyday life (Papula, 2013). Cloud computing is the latest trend to outsource some or complete IT operations to run a business from the public (Subhankar, 2012) Cloud that provides a flexible and highly scalable technology platform for an organization's business operations (Armbrust et al., 2010; Badger et al., 2011; Catteddu and Hogben, 2009). A cloud computing enables users to store their data into a cloud to enjoy scalable services on-demand. Especially for small and medium-sized enterprises with limited budgets, they can achieve cost savings and productivity enhancements by using cloud-based services to manage projects, to make collaborations, and the like (Wang, 2010). In this paper we will discuss the usage of cloud computing withing the

Document Management Systems (DMS) and show the contribution of it. Advantages of the electronic document management system are among other things, monetary savings (productivity, cost reduction, space, time, systems) and also not monetarily values (increase in consistency, multi user, processing simplification, faster and more targeted relevant search). The process-oriented management system standard ISO9001: 2015 speaks explicitly of documented information and favors a more customer experience improvement. A certification under this standard sets a functioning quality management system as a necessary construction for documented information.

However, after an initial hype, cloud computing has not reached the expected growth. Many organizations are concerned with problems and risks to store information in the cloud. These problems will be also discussed in the paper. At first, this paper will show the basics of the standard ISO9001: 2015 and cloud computing as a solution for the document management system. Then the research will follow. The study will show the current opinion of the norm and cloud computing in Germany based on a questionnaire. In the last part of paper, there are presented results and possibilities of improving confidence.

2. Literature Overview

2.1 DMS

The term "document" comes from lat. "documentum", that derives from the Latin word "docere", that means "to teach", to acknowledge someone on something. (Duden, 2016) Document is any object, anything apt to let a fact be known. (Carnelutti, 1957) Documents are all objects on paper or in electronic form providing information for operational processes.(Riggert, 2010) The Document Management System (DMS) manages the handling of the data. DMS arised out of archive systems to simplify management and access in the 1960s. DMS have been continuously developing since the end of the 1990s. It stands in relation to knowledge management and content management systems. (Schütz et al, 2004) Today, these approaches how manage data, knowledge and information are not just ways of building competitive advantages, they are rather a necessary condition for successful operation of companies. This is reflected in all areas of industry, trade and services, where there is an increasing pressure on managers on quantity, timeliness, veracity and transparency of information they need for their decision making. (Papula, 2008)

2.2 ISO

The International Organization for Standardization (**ISO**) is a worldwide federation of national standards bodies based in Geneva, with the aim to create rules and proposed modes of action. Normative guidelines, however, do not have the force of law unless the legislator makes their application compulsory. (Herzog Wiesner, 2004) The structural design of standards in Germany follows the nomenclature of ISO standards, EN standards, DIN standards. Thus the directives of the international ISO standards are first transposed into European standards (EN). In Germany, those directives are finally transposed into regional standards (DIN standards). The ISO 9001:2015, as one of the most important cross-industry standards, follows the "... basic structure according to ISO management system standards **High level Structure**". (ISO9001, p.2) The ISO9001:2015 is the only standard according to which certification is possible, within the group

of ISO900x, with certification not being necessary but nevertheless appropriate helpful. Ultimately, successful certification confirms that a process-oriented quality management system has been introduced (according to the applicable standard), maintained, and developed. (ISO9001, p.20) The overall benefits of the **quality management system** (ISO9001, p.8) are strategic decisions that help to create quality in accordance with law and the regulatory requirements of compliant products and services. To remain customer-oriented to work or to increase the performance rate, to increase the overall performance, related processes to understand and to control and to improve the efficiency of an organization. (ISO9001, p.10) The standard can be applied for all company sizes and legal forms of enterprises of manufacturing industry and crafts and has been extended to the services sector. (ISO9001, p.4) So like this standard, in addition to the principles of quality management (customer-orientation, leadership, involvement of people, process approach, improvement, evidence-based decision-making, relationship management) (ISO9001, p.10) sets the requirements for a quality management system and defines the scope of application. (ISO9001, p.170) The aim of these requirements is a continuous quality improvement of the quality of products, services and customer satisfaction and the complete control of the quality process, in which the iterative Shewhart cycle (dating back to 1939; later better known as the Deming cycle) or the even more advanced **PDCA cycle** is applied. (ISO9001, p.17) This PDCA cycle implies a continuous process improvement of the process as well as the adaptation to new conditions as risk-based thinking explicitly recommended within the standard, as a basis for action. (ISO9001, p.11) In addition it enables continuous process application, Plan-Do-Check-Act and serve continuous enhancement. Unfortunately, on this point the ISO9001:2015 is not as far developed as the Japanese Kaizen, for example.

Documents that represent the scope of application and the processes of the quality management system, formulate quality policy, goals, and so on and as **documented information** (ISO9001, p.19) **must** be available, maintained, continuously improved and saved including the preservation of legibility. (ISO9001, p.31) This includes the entire life cycle of the relevant documents and includes a steering and thus controlled provision of documented information. The quality management system and its processes require:

- Maintaining documented information in order to support the implementation of processes
- Keeping documented information, so that one can be sure that the processes will be carried out (exactly) in the way they were planned

This is set by the international standard ISO9001:2015, which has also the status of an EN standard and a DIN standard, that sets regulatory limits set in which the certified companies can move. It does not set explicitly how things have to be done, but it defines the exact framework within which things can be done. The organization requires resources for building, achieving, maintaining and continuously improving of the **quality management system**. (ISO9001, p.25) This includes the infrastructure, initial-investment and costs of operation, which is very cost-intensive due to the cyclic exchange of hardware / software and cost for trustworthy IT staff. There are another additional costs such as buildings, equipment, utilities, logistics, communication technology, safety technology, staff etc. In addition one must observe: (Braunstein, 2011)

- Backup and archiving of documented information, security relevance
- Data protection, administrators and staff members working on documents (56% a study by PWC said "... that the worst offences have been committed internally.")

The information must meet certain criteria: (ISO9001, p.30)

- Adequate labelling including metadata and reference number
- Adequate (actual) format
- Creation, review, and approval according to the six-eyes principle (creating, testing, licensing)
- Targeted steering (process oriented on jobs / employees)
- File protection, confidentiality, integrity
- Storage and backup (readability)
- Archiving (readability)

The ISO standard ISO 9001:2015 provides so many exact specifications and also needs documents resistant to change and versions safely created and maintained. To do this, a **document management system** is needed which is suitable as a convenient solution for versioning, single shelf, unique deployment (only) of the current document, indexing etc. The requirements of the (voluntary) certification according to ISO 9001:2015 are satisfactory yet difficult but without a documents management system. The system used in addition to the handling of documents in the life cycle of the process until the final destruction or archiving - needs to find a reliable way of storage. This can take place either in the company (in house), or (not only to reduce investment costs) at a special (appropriate) service provider via outsourcing, **cloud computing**.

2.3 Cloud Computing

Cloud computing means the need for specialized provider and the required resources (disk space, CPU time, services, infrastructure) via defined interfaces on the Internet provide. (Dunkel et al., 2008) The storage of digital data is done in server farms which, in order to keep the cooling effective, are usually set in locations that are favourable in terms of energy (i.e. rather in cooler regions, e.g. the Arctic). Technical requirements are a (solid) power supply (emergency power supply usually remains complementary in the company), fast reliable data nodes. Well-trained and reliable staffs with a good reputation as well as stable political conditions in the region are also required. Set against this background a server farm can be built **anywhere in the world**. The benefits of cloud computing are obvious. Data, for example, is accessible from anywhere with any network-enabled device. The provider offers a large, safe, functional, redundant infrastructure as well as data access control, secure storage and high reliability due to split drop. (for example according to the RAID principle, this can improve Data saving such as Backup). (Schneider, Werner, 2007) Organisations guarantee this by providing cyclic **tests and Softwarevalidation**. (Steffen, 2007) The cloud applications (for example, the data storage) are highly scalable (Abts, Mülder 2013) for high dynamic numbers of users and independent of the technology of hardware and software, as well as spatially independent of requirements. "Peak demand will be met quickly and just as quickly the system will return to the idle state". (Steffen, 2014) High investment costs become lower costs of ownership / user costs because only the time of use / the usage volume of the utilized resources are invoiced.

After an initial hype with regard to the data storage in the cloud, which implies many benefits, security concerns emerged, because data was filed *somewhere* and it was not exactly defined where and which path it took. This includes aspects like: data security, industrial espionage and cyber threats. If transferred to *interested parties* this means that non-authorized persons can get data access, data reliability is reduced, data is lost and cyber crime increases. The security concerns have not disappeared so far away. A study by PWC from 12 / 2011 mentioned that frauds via Internet applications were on the rise. Quote: "... so that cybercrime now belongs to the four largest white-collar crimes." (Braunstein, 2011) Another, more internal business problem is similarly also located on the data path. If we assume an average safety-critical company, the data is encrypted only when leaving the internal network. On the way from the (first) device to the server, it runs unencrypted over at least one switch that is located on an OSI layer 2 or 3. Thus, for the data affine employees or administrators the content are still **quite readable**.

3. Methodology of Research

In order to find out about the current point of view on the recommendations of the standard and the confidence in cloud computing, questionnaires were sent out to manufacturing companies in September 2016 with a turnaround of two weeks. All the questionnaires are a part of a larger survey on the topic of **document management systems**. This larger study will be carried out within the framework of a dissertation and examined the long term reliability and serviceability by document management systems. These two facts are important in the long-term use of an application system that will comply with at least the statutory requirements for the archiving of documents e.g. six or ten years. To do this, companies producing 46 requests were sent out in Germany.

The following questions (here we are going to mentioned only few from whole research) were asked with regard to the point of view on standards, the importance of compliant document management systems (application software) and the importance of complying with legal provisions:

Question 10: *How important is compliance?*

Question 13: *How important is the compliance with all legal provisions by the document management system?*

Question 41: Question related to the issue of long time reliability.

Does long time reliability for the document management system mean compliance?

In next set of questions, we asked about the company's confidence in cloud computing:

Question 42: *In terms of serviceability, is the cloud an important future system for your new system?*

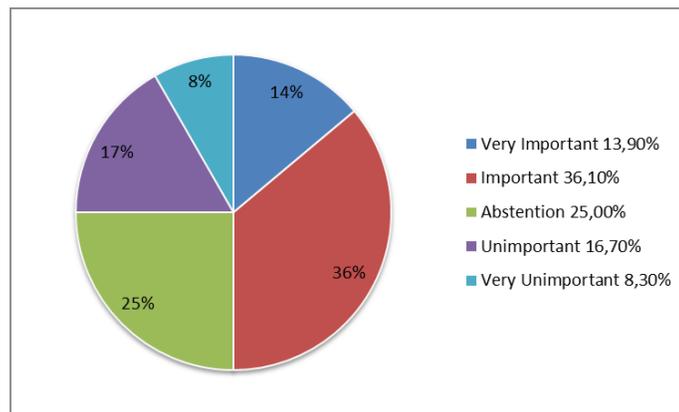
Question 43: *What do you think about the cloud technology, storage system of business-relevant files / documents in the cloud?*

Question 44: *In your opinion, where does cloud computing offer potential for improvement?*

Cloud services are by fair not only useful for simple data storage in the way we discussed in this paper. They can actually be broken down into a cloud stack as follows: (Abts, Mülder, 2013, Oyelude, 2015)

- Application, Software as a Service, **SaaS**
such as: Amazon Simple Storage, Dropbox
- Platform, Platform as a Service, **PaaS**
such as: Microsoft Windows Azure
- Infrastructure, Infrastructure as a Service, **IaaS**
such as: Google Maps

The question was asked with regard to **SaaS**: What do you think about software as a service, SaaS? Is this a way of reducing costs due to the fact that only the actual use of time / volume is cost-relevant? The following answers were given:



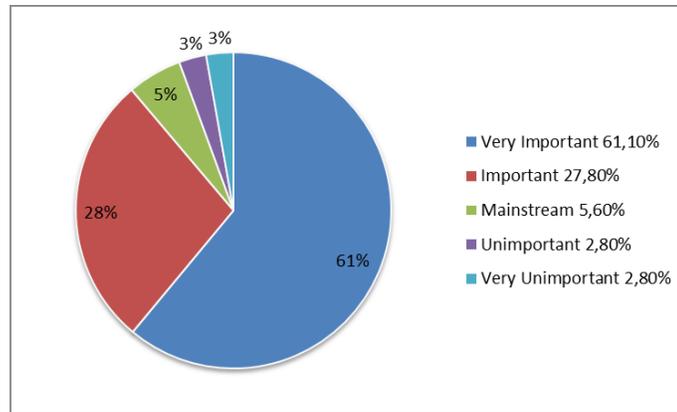
Picture 1: Results SaaS

The use of the platform, PaaS or the use of infrastructure, IaaS, contains another potential, are not considered in this paper. The result shows 50% of the users are of the opinion that SaaS has a potential for reducing costs and consider it as important. However, 25% are apparently undecided. Software as a service, SaaS can be therefore a reduction in the investment costs. Just 25% regard them as unimportant (16.7%, 8.3% as very unimportant).

4. Results and Discussion

The survey yielded a backscatter ratio of 23% at 1,050 transmitted requests. About 8% from the organisations were no longer active or communication data was wrong. This response rate can be described as very good for an online survey, and shows a lively consideration of the interesting topic. The focus of the responses roughly reflects the currently dominant image of cloud computing and emphasize the importance of the international standard ISO9001: 2015 and its certifications. After an initial hype a few years ago the demand for data storage in the cloud has decreased. (Columbus, 2012) The opinions have changed. And at the moment apparently still of lack of data protection. This is probably the problem. The responses in detail are as follows:

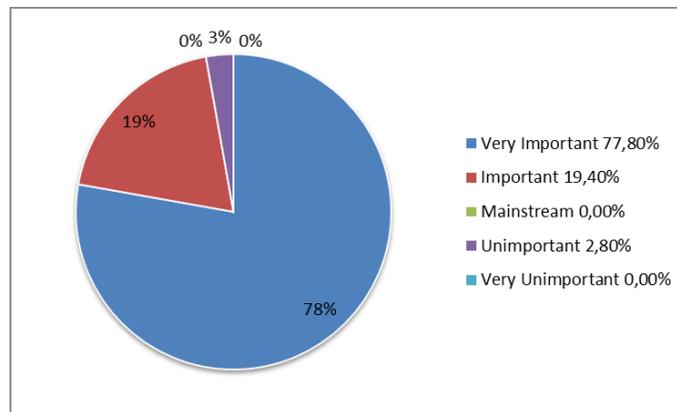
Question 10: *How important is compliance?*



Picture 2: Question No. 10

88.9% of the responses emphasize the **importance** of the **standard** (27.8%) as important and classify the issue as very important (61.1%). The questionnaires were sent to individual companies as well as small and medium-sized companies thus representing a wide-ranging survey. For companies like this standards or certifications may not be as relevant as for larger companies or for suppliers. Conformance is crucial for a successful certification according to ISO 9001:2015.

Question 13: *How important is the compliance with all legal provisions by the document management system?*



Picture 3: Question No. 13

Regulatory compliance by the document management system is valued as important by 97,2 %, exactly 19.4% consider regulatory compliance as important, 77.8% even see it as very important.

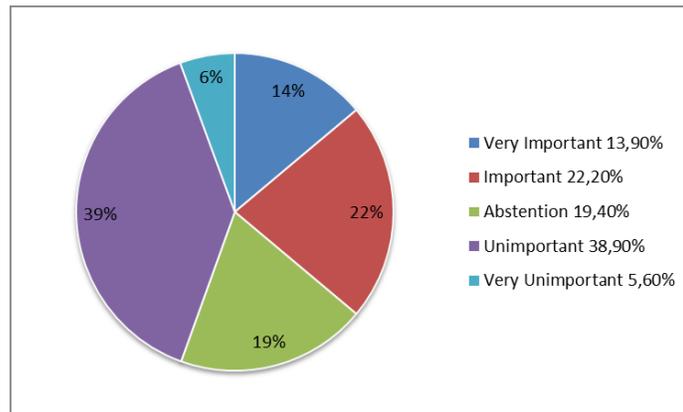
Question 41: Question related to the issue of long time reliability.

Does long time reliability for the document management system mean compliance?

33.3% of the respondents marked standards as a requirement for document management systems. That means, it would be important for a third of all of them if there was be a standardized system

with the known advantages of this procedure, such as uniformity and accountability and recognition by a larger panel. In contrast to the 33,3 % above only 30.6% have marked verified. That means (only) a test of the software.

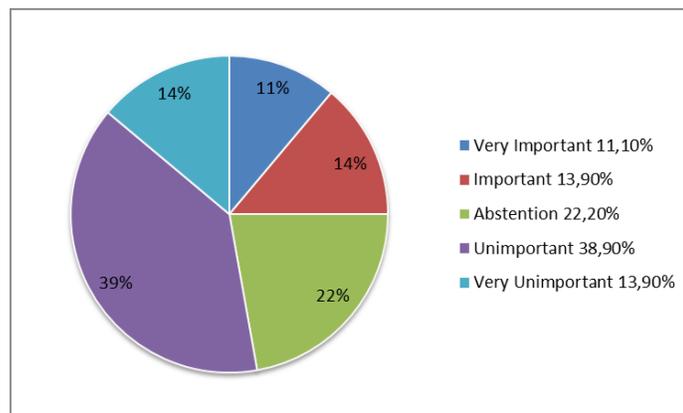
Question 42: *In terms of serviceability, is the cloud an important future system for your new system?*



Picture 4: Question 42

The majority of the respondents (38.9%) understand cloud computing as rather unimportant. Only 13.9% as very important, 22.2% as important, even 5,6% even see it as very unimportant. This may be due to the problems which will be further outlined.

Question 43: *What do you think about the cloud technology, storage system of business-relevant files / documents in the cloud?*



Picture 5: Question No. 43

The answers reveal some interest in the storage of corporate data in the cloud, 11.1% consider it to be very important, 13.9% to be important. In connection with question No 44 (essay question) 81.8% of the answers mention privacy protections.

Question 44: *In your opinion, where do cloud computing offer potential for improvement?*

When assessing the existing potential for improvement, 78.3% of all respondents recognize problems with inadequate data protection or security risks. 56.5% explicitly name the word "privacy-problem" in the replies. This shows the active problem. Among the responses were:

- No need to outsource company (sensitive) information
- Hosting of the Data are not definite
- Concerns about technology transfer
- At what point, where is the data hosted?
- Full disclosure of data protection
- Who / how many people get access to our data?

A full **deep encryption** of data from (1st) device to device can be one solution, for instance. Here, the way of the data is already specified from the first data unit in the enterprise to the last data unit. Thus, the three goals of integrity, authenticity and commitment can be achieved. Hash functions, mathematical functions, are required from plain text after a certain mathematical procedure to do this, a fingerprint (hash, message digest, MD) produce. The RIPEMD project with a length of 160 bits of Hashcode in the frame of the EU seems to prevail as the de-facto standard in Europe. (Semar, 2004) However, this effort by the first data unit must be used consistently.

5. Conclusion

So far unconvincing data protection inhibits the proliferation of cloud computing. As a more important finding from the standard (ISO9001:2015) **increases the responsibility of senior management** also for data security. Therefore the IT Strategy is derived for the next years rather more out of the company's strategy. As an important approach to the successful implementation of complex strategies and structures in IT is the approach of the enterprise architecture management, EAM, including for the processes of documentation. (Hanschke, 2013) In an continued question could be studied, in how far a certification would have a standardised system relevance. And, it should be examined in how far the **Open archival information system, OAIS** can usefully help. But, the privacy problem (Data Security) we can't get around - even this model does not. (Keitel, Schoger, 2012) „These and other technologies can be marshaled to manage the explosive growth of data ...” (Braunstein, 2011) Especially the tremendous growth of data in document management is the problem. And cloud computing is suitable, consisting “... of reliable services delivered through data centers and build on servers with different levels of virtualization technologies.” (Braunstein, 2011) It needs to be done **very much for the security** and trust must be rebuilt. Our survey impressively confirms the problem already detected in earlier studies to a little bit clear and offers explanations for it. Our study shows there IS still many reservations **against cloud computing**. Therefore work on confidence-building should be continued.

References

Abts D., Müller W., Grundkurs Wirtschaftsinformatik, 8. Auflage, Springer Vieweg, Wiesbaden, 2013, ISBN: 978-3-38348-1669-6.

- Armbrust, M., Fox, A., Griffith, R., Joseph, A.D., Katz, R., Konwinski, A., Lee, G., Patterson, D., Rabkin, A., Stoica, I. and Zaharia, M., A view of Cloud computing, Communications of the ACM, Vol. 53 No. 4., 2010.
- Badger, L., Grance, T., Patt-Corner, P. and Voas, J. , Draft-Cloud Computing Synopsis and Recommendations, National Institute of Standards and Technology, Gaithersburg,MD, May 2011.
- Braunstein Cal .Monthly News DACH, Studien zum Thema Cyberkriminalität und Sicherheit, , 12/2011, Internetquelle aus: experton Group, http://www.experton-group.de/research/monthly-news-dach/news.html?tx_ttnews%5Btt_news%5D=3320&cHash=168f119a77d615a636950516b1fb4fc9, Abruf: 02.11.2016
- Catteddu, D., Hogben, G., Cloud computing: benefits, risks and recommendations for information security, European Network and Information Security Agency, 2009 available at: www.enisa.europa.eu/act/rm/files/deliverables/Cloud-computing-risk-assessment, Abruf: 12.11.2016
- Carnelutti. Documento - theoria moderna, in Nov. Dig. It. Torino, 1957
- Columbus L., Hype Cycle for Cloud Computing Shows Enterprises Finding Value in Big Data, Virtualization, Forbes, 2012, Internetquelle: <http://www.forbes.com/sites/louiscolombus/2012/08/04/hype-cycle-for-cloud-computing-shows-enterprises-finding-value-in-big-data-virtualization/#69c7e7ed1820> , Abruf: 10.11.2016
- DIN EN ISO 9001:2015, November 2015
- Duden, deutsche Rechtschreibung, 2016, Internetquelle: <http://www.duden.de/suchen/dudenonline/dokument>, Abruf: 10.11.2016
- Dunkel J., Eberhard A., Fischer S., Kleiner C., Koschel A., Systemarchitekturen für Verteilte Anwendungen, Carl Hanser Verlag, München, 2008, ISBN: 978-3-446-41321-9
- Guojun Wang, Qin Liu, Jie Wu. Hierarchical attribute-based encryption for fine-grained access control in cloud storage services. Proceeding CCS '10 Proceedings of the 17th ACM conference on Computer and communications security, 2010, pp. 735-737.
- Hanschke I., Strategisches Management der IT-Landschaft, Hanser Verlag, München, 2013: ISBN: 978-3-446-43509-4.
- Herzog G., Wiesner H-J., Normung aus Kuhlen R., Seeger T., Strauch D. (Hrsg.), Grundlagen der praktischen Information und Dokumentation, 5. Auflage, KG Saur, München, 2004, ISBN: 3-598-11674-8
- Keitel C., Schoger A., Vertrauenswürdige digitale Langzeitarchivierung nach DIN 31644, Kommentar, DIN e.V., Beuth Verlag, Berlin, 2013, ISBN: 978-3-410-23499-9
- O'Brien J., Marakas G., Management Information Systems, 10. Auflage, McGraw Hill, New York, 2011, ISBN: 978-0-07-122109-2.
- Oyelude, A.What's trending in cloud computing from the internet cybersphere, Library Hi Tech News, Vol. 32,Iss 10, 2015, pp. 22 – 23.
- Papula, J. Manazersky pohľad na pravy vyznam sucasnych ICT. eFocus 4/2008. s. 58-61. ISSN 1336-1805.
- Papula, J. Skusenost' s prechodom od LMS Moodle ku cloudovemu LMS iSmart, Aplikacie informacnych technologii. č. 1/2013, s. 73-82, ISSN 1338-6
- Riggert W., Vorlesung FH Flensburg zum Thema: Dokumenten Management, Flensburg, 2010
- Schütz Th., aus Kuhlen R., Seeger T., Strauch D. (Hrsg.), Grundlagen der praktischen Information und Dokumentation, 5. Auflage, KG Saur, München, 2004, ISBN: 3-598-11674-8
- Schneider U, Werner D., Taschenbuch der Informatik, 6. Auflage, Hanser Verlag, Leipzig, 2007, ISBN: 978-3-446-40754-1, S.139f
- Semar W., Kryptografie aus Kuhlen R., Seeger T., Strauch D. (Hrsg.), Grundlagen der praktischen Information und Dokumentation, 5. Auflage, KG Saur, München, 2004, ISBN: 3-598-11674-8
- Steffen H., Softwarevalidierung in der Medizintechnik, VDM Verlag, Saarbrücken, 2007: ISBN: 978-3-8364-3-0647-5
- Steffen H., Trends in Management 2014, Eastern Institute for Integrated Learning in Management University, Symposium Arona, ISBN: 978-3-86468-705-1

Subhankar D., From outsourcing to Cloud computing: evolution of IT services, Management Research Review, Vol. 35 Iss 8 pp. 664 – 675, 2012.