

Quality Evaluation of Electronic Data Exchange System between Business and State Authorities

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Abstract

The paper presents a new view of quality evaluation of a system of electronic data exchange between a business and government. A method for evaluation of the electronic data exchange system between a business and state authorities is presented in the paper. The method is called CBG (Communication between Business and Government). A goal of the CBG method is to evaluate the system of electronic data exchange between a business and state authorities, not only to evaluate applications such as an electronic data box or an electronic submission of tax. A pilot version of the CBG method provides a tool to evaluate and measure important attributes of the electronic data exchange system between businesses and state authorities.

Key words

Electronic data exchange, state authority, evaluation of quality, attribute, method.

Anotace

Příspěvek představuje nový pohled na možnosti hodnocení kvality elektronického systému výměny dat mezi podnikem a státní správou. V článku je navržena metodika hodnocení kvality elektronické výměny dat mezi podnikem a státní správou — metodika CBG (Communication between Business and Government). Cílem metodiky CBG je ohodnotit celý systém elektronické výměny dat mezi podnikem a státní správou, nikoliv jednotlivé aplikace, jako jsou např. datové schránky nebo elektronická podání. V pilotní verzi metodika CBG poskytuje možnost ohodnotit a změřit důležité atributy, které popisují fungování systému výměny dat mezi podnikem a státní správou.

Klíčová slova

Elektronická výměna dat, státní správa, hodnocení kvality, atribut, metodika.

Introduction

Since recent time, businesses have increased an effort to use electronic workflow and electronic exchange of documents among businesses. There are clear contributions in doing that - savings of time and costs on paper document workflow. On the other hand, issues of security, archiving and storage of electronic data need to be solved.

Bodies of the Czech state authorities have started to offer a modern way of electronic communication with enterprises and individuals, for example a network of checking and submission spots (Czech POINT), or an information system of data boxes, electronic submissions at different state offices and other ways. Enterprises can also communicate with

state authorities by means of a common electronic mail or download, and fill forms at a website of state authority. All communication channels constitute a system of electronic data exchange between an enterprise and a state authority. It is wanted to make a qualitative evaluation of such a system.

Material and methods

A goal of the paper is to analyze choices of evaluation of quality of the electronic data exchange system between an enterprise and state authorities.

A basic platform is a literature overview and an analysis of state-of-the-art of electronic

communication between an enterprise and state authorities. There is an analysis of techniques of quality evaluation of a software and an information system. After synthesis of theoretical facts and expert suggestions, the method of evaluation of quality of the electronic data exchange system between an enterprise and state authorities is proposed. The method is to be checked in one practical example.

Electronic communication of business

There are several levels of the electronic communication. A company usually communicates with:

- internal;
- other companies;
- customers;
- state authorities;
- bank and insurance offices.

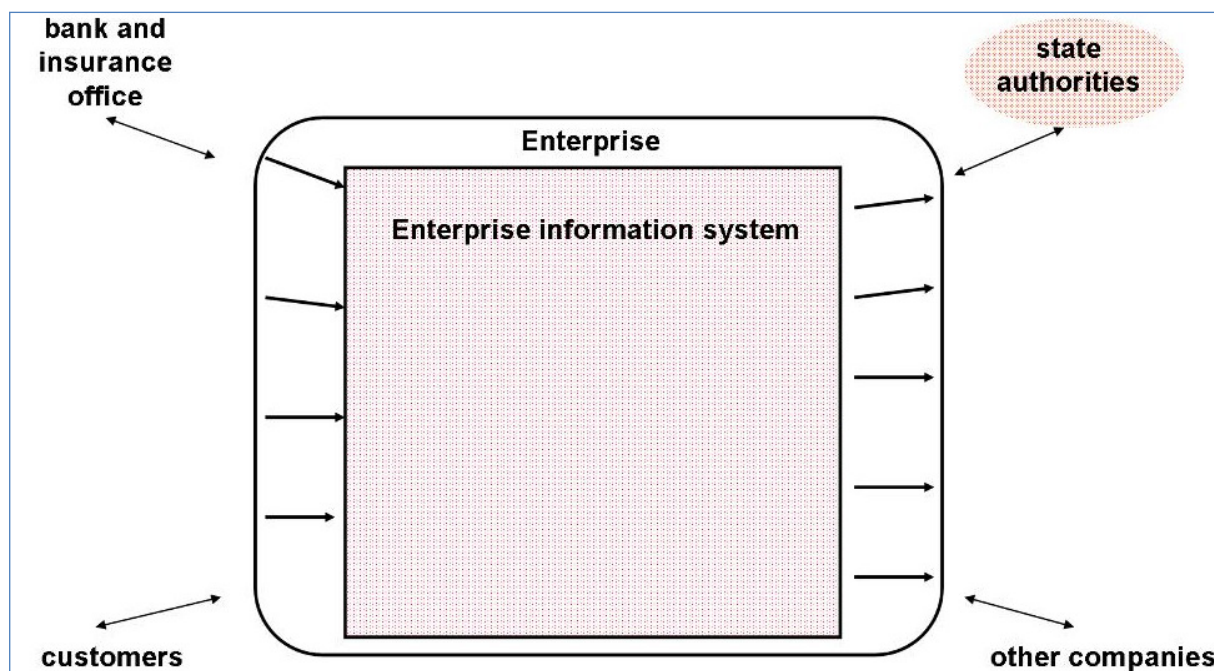
Each level of communication has some differences that have to be accepted by a company. For example, a communication of company with a tax authority has to comply with the law and notices. When the company communicates with a customer,

it must accept a form of the communication that is expected from the customer.

The current state and level of a communication between a company and state authorities is described in a research of the Czech Statistical Office [1] and Peterka [2].

The extent of the electronic communication among businesses (B2B, Business-to-Business) is very dependent on a size of business. While the smallest companies utilize the electronic communication B2B in less than 19 percent, the largest companies in more than 60 percent, as states Peterka [1] in an analysis of data exchange among enterprises in the Czech Republic.

In January 2009, 66 percent of companies responded that they communicated with the public administration through the Internet in 2008. The communication with the public administration through the Internet was mostly used by large companies (more than 250 employees) in 96 percent. On the contrary, small companies (from 10 to 49 employees) used the Internet towards the public administration in 59 percent. Generally, the smaller company, the lesser is the involvement in the electronic communication with state authorities [1]. The paper introduces a procedure how to evaluate the communication between a business and



Source: Own source

Figure1: Levels of communication of business.

state authorities. The authorities include all organizational units of the state that are listed in a methodology of the Czech Statistical Office in a research of usage of the information and communication technology in a public office in 2008. The organizational units are: ministries, courts, prosecution, labour offices, offices for surveying, mapping and cadastre, hygienic site services, state veterinary administration and a few other [1].

Quality evaluation of electronic data exchange

In general, the business process is a sequence of activities that transform input and measureable resources into output. The output is added with a value. The resources are: money, people, knowledge, other intangible assets, other processes' products or products and services purchased outside the company, machines and equipment, ICT, buildings, other tangible assets and energy.

The process can be classified either as a main process or as a subsidiary process. The main process leads to fulfilment of business goals and creates an added value that is paid by a customer. It is a sequence of activities that starts from a customer's requirement to its satisfaction and payment. Subsidiary processes can be supported even externally without a threat to the business. An internal support of the subsidiary processes is used either to prevent a risk, or to reduce costs.

The electronic data exchange is a subsidiary process according to characteristics stated above. The process is conducted between two companies or between a company and a state authority. Under the process of electronic data exchange, ICT resources and working hours of people are consumed, while a data message is transmitted. The result is an electronic delivery of data. An added value is time and cost savings that would be spent if the data exchange were not conducted electronically.

Companies want to get the best business process performance which means to perform activities with the lowest possible costs and at the same time with the best possible value for a final customer. The measure of performance and quality of the process is a subject matter of a business process management (BPM).

Electronic data exchange is conducted by means of ICT, i.e. software and hardware. Software and hardware are generally products and they can be evaluated as products from different points of view. A set of all significant product characteristics and a degree to which they fulfil requirements are called quality. An evaluation of quality of the software is a subject matter of a special scientific discipline. Vaníček [4] mentions also a quality in use of software product besides the quality of a product. Then it is possible to measure a quality of the process of electronic data exchange as the quality in use.

The measurement of the product quality or the quality in use always regards requirements of a user of the product.

The standard ISO 9000 [3] specifies a requirement as a need or expectation that is: a) stated, b) generally implied, c) or obligatory (e.g. according to a legal act). Special requirements are described in a document, for example in a purchase contract. The phrase "generally implied" means a common practice in a company, of a customer or other interest groups. Requirements have to be generated from real needs of the interest groups.

Requirements are stated in a form of required value of a measure of each attribute that is called an indicator. Then, a real value is measured and is compared to the required value of the measure. Results of the comparison are aggregated into a final evaluation. The final evaluation of the quality can be stated for example in an ordinal scale that represents the quality as: excellent, good, sufficient and insufficient.

The software quality measurement is a subject of international standards ISO/IEC 9126, 14598 and 12119. All three norms were accepted by the Czech Normalisation Institute as CSN norms. The paper written by Vaníček [4] describes three different views of the software quality evaluation:

1. External quality, as a measure of satisfaction of requirements of a product user. It can be measured after the product is finished.
2. Internal quality that is given by characteristics of a software product during its implementation. It predicts its quality into the future.

3. Quality in use that evaluates a quality of process of the product use after its implementation.

The quality is divided by ISO/IEC 9126 into six different categories called quality characteristics.

FUNCTIONALITY: is an ability of a product to ensure required functions (it is important to have functions available, neither a manner, nor price of functions).

RELIABILITY: is an ability of a product to ensure the required level of performance and provided services under given conditions.

USABILITY: is an ability of a product to be used with an adequate effort needed to get to know functions of the product and to use it under given circumstances.

EFFICIENCY: is an ability of a product to ensure services with adequate demands on system resources and in an adequate time.

MAINTAINABILITY: is an ability of a product to be adjusted to requirements of a user during its usage, an ability to improve revealed insufficiencies, to develop and improve functions or an ability to change the environment for the product (hardware, software, but even legislative).

PORTABILITY: is an ability of a product to cooperate with other systems on data and process level, including systems that run on different platforms (data, software and hardware).

To get a finer structure of requirements, there are quality sub-characteristics of each characteristic. The last level of the structure is an quality attribute that can be physically measured. An attribute can have influence on several sub-characteristics that come under different quality characteristics.

Presumptions for quality evaluation of electronic data exchange system between business and state authorities

An idea of the quality evaluation of the data exchange between a business and state authorities is based on several presumptions. Presumptions are motivated by practical demands that were

recognized during the literature review and the research in practice.

1. Presumption: *Is the use of ICT in a business in compliance with the real business processes?* The deployment of ICT in a business is a contribution, if there is compliance between the information system architecture and business processes.
2. Presumption: *Does the electronic communication in the business bring a real cost and time savings in comparison with the other ways of communication?* The significant contribution of ICT is brought by the electronic communication among companies and their information systems.
3. Presumption: *Is it possible to receive and send electronic data in a format acceptable to the information and communication system of a partner subject?* There is a need for a standardization of data transfer between a business and particular state organs.
4. Presumption: *What is the degree to which users' requirements are fulfilled by the electronic data exchange?* There is a need of a quality evaluation of the electronic data exchange system between a business and state authorities.
5. Presumption: *Are the data valid, consistent and without redundancy?* There is a need of data sources integration, especially to remove duplicity of data which emerges from the electronic data exchange between a business and state authorities.

The procedure that is designed and described further, shall verify presumptions stated above and become a basis for a new method of the quality evaluation of the electronic data exchange system between a business and state authorities.

Method proposal of quality evaluation of electronic data exchange system between business and state authorities

A method is proposed on the basis of a theoretical study and an analysis in the previous chapter. A construction of the method was supported with knowledge and experience of developers of

information systems for businesses and state authorities. Also requirements of users of information systems from several agricultural businesses are included.

The proposed method is assigned for the quality evaluation of the electronic data exchange process between a business and state authorities. It is not intended for an evaluation of particular applications that support the data exchange because these applications have been still being developed, updated and changed. Hence the management of businesses is interested in the final effect of information systems used in a company, the method measures the quality in use, as it was described in the previous chapter. The method evaluates the quality in use of the electronic data exchange system from the point of view of people working in state authorities and businesses.

In the further text, the new method is shortly called CBG (Communication between Business and Government) method.

The following contributions are expected with the proposed CBG method:

1. An opportunity to assess the quality of the electronic data exchange system between a business and state authorities according to these characteristics:
 - **Characteristic no. 1 — Effectiveness:** an ability of the system to ensure achievement of goals in precise and full manner.
 - **Characteristic no. 2 — Productivity:** an ability of the system to ensure effectiveness with an adequate use of resources.
 - **Characteristic no. 3 — Safety:** an ability of the system to permit only an adequate

degree of risk of threat to people, environment, property or business interests under the use of system in the given context.

- **Characteristic no. 4 — Satisfaction:** of a user with use of the system.
2. An opportunity to assess the quality of electronic data exchange system between a business and state authorities from a point of view of different parties:
 - system users (employees in a state office or in a private company),
 - management (of a state office or of a private company),
 - developers (in a software development company),
 - an independent evaluator (a person that independently assesses a quality of the system, such as an auditor or an independent consultant).
 3. CBG method shall become a tool both for the company and the state office users to assess the contribution of ICT in a communication between the company and state authorities.
 4. CBG method evaluates the electronic communication between a company and state authorities excluding regions and municipalities because they are characteristic of large differences in ICT utilization.
 5. System developers can identify new opportunities to the use ICT in state offices and in private companies.
 6. State office managers can identify new areas of improvement of the electronic communication for the state and legislation. In the Czech Republic, the method can have impact on e-government projects as Czech POINT, data boxes and base registries.

CBG method: Sequence of steps	User	Manager	Developer	Evaluator
1. Definition of the electronic data exchange system requirements of groups of users	✓			✓
2. Transformation of requirement into attribute measures.				✓
3. Weighting of attribute measures.	✓			✓
4. Quantification of indicators that should be achieved.	✓			✓
5. Measure of actual attribute values.	✓			✓
6. Comparison of indicators values with actual attribute values.				✓
7. Aggregation of results and final recommendations.		✓	✓	✓

Table 1: List of steps of CBG method.

The first step, groups of users and their requirements are defined. This is done by an evaluator together with a representative of users in an organization. The representative is designated by a manager.

The second step, the evaluator transforms the requirements into attributes and their numerical representation of measures called indicators. Each attribute belongs to at least one of the quality characteristics. Each quality characteristics is represented by one or more attributes. The evaluator sets one question for each attribute for a questionnaire (see step 5). A result of this step is an evaluation form for each quality characteristics of the system (see the appendix).

The third step, the representative of users together with the evaluator set weight to every attribute. The reason is that each attribute has a different importance for the particular group of users. In spite of the fact that weighting is a very subjective activity, it shall be conducted with responsibility and by an experienced worker in the company. Possible mistakes must be taken into account. To minimize a mistake, a weight is set according to a scale in the following table (the second column in the table holds a per cent value of the weight).

very high importance	100%
high importance	75%
average importance	50%
little importance	25%
no importance	0%

Table 2: Weight of the attribute importance in the quality evaluation of the electronic data exchange system.

The fourth step, the representative of users and the evaluator set indicators. The required value of each indicator is expressed with points. Each attribute is assessed with points that mean a level of agreement of a respondent with the statement or question that describes the attribute of the quality characteristics. The range of scale is from one to five points and is associated with following levels of accordance (see the Table 3).

The fifth step, the evaluator measures actual values of attributes. The values are weighted and filled in an evaluation form for every quality characteristics. The evaluation form is filled in by a representative and the evaluator during an interview. There is one statement or question for each attribute of quality in

1 point	not done yet
2 points	partially done
3 points	done with average quality
4 points	done with very good quality
5 points	perfectly done

Table 3: Points assignment to the attribute of characteristics.

the form. A respondent allocates an appropriate number of points to each statement or question by a level of accordance (see Table 4).

The sixth step, indicators' values and actual values are compared by the evaluator. After, results are aggregated and a final statement about a quality of the system is made. The final quality assessment in ordinal scale is in the following table.

excellent	1
good	2
sufficient	3
insufficient	4

Table 4: Final quality assessment by the CBG method.

The seventh step, the evaluator summarizes results of the quality assessment and formulates recommendations for the organization in a form of steps that shall increase the quality in given areas and shall get the organization closer to the indicated values. The recommendations are delivered to the manager of the organization and to the developer of the information system.

Results and discussion

The method for quality evaluation of the electronic data exchange system between a business and state authorities (CBG method) was verified in practice. However, the CBG method needs to be verified in at least two different organizations that already utilize the electronic communication with state authorities.

The author supposes that the method will be also applicable to the evaluation of quality of the electronic data exchange system in municipalities and regions.

The proposed CBG method is for the evaluation of electronic data exchange system between a business and state authorities. A goal of the method is to evaluate the system of electronic data exchange between a business and state authorities, not only to

evaluate applications such as an electronic data box or an electronic submission of tax. A pilot version of the method CBG provides a tool to evaluate and measure important attributes of the electronic data exchange system between a business and state authorities. According to the comparison of the indicated values and actual values it is possible to formulate the final quality assessment of the electronic communication between a company and state authorities and to suggest a recommendation for improvements.

Appendices

Evaluation form – sample

An evaluation form in the following table is to be built by an evaluator in cooperation with a representative of users in an organization – see step 2 of the method CBG.

The form is filled in by the evaluator in steps 3, 4 and 5 of the method during an interview with a representative of users in an organization utilizing the electronic communication with state authorities.

	Attribute	Question	Weight (0-100 %)	Required (1-5)	Actual (1-5)
1	Accordance in legislation	Is there a legislative or a law proposition of the data exchange? <i>Example: Submission of the value added tax form.</i>			
2	Rate of accordance with legislation	To which extent is the data exchange in accordance with the requirements of the legislation? <i>Example: Are there all required items in the electronic form for the value added tax submission?</i>			
3	Accordance with referential data	Are there referential data in the state authority's registry? (Relates to data exchange with state authorities) <i>Example: Corporate income tax return.</i>			
4	Accordance with the verification of referential data	Is it possible to verify the data message with the referential data? <i>Example: Access to Registers of Economic Subjects / Entities (ARES)</i>			
5	Rate of accordance of referential data	To which extent are data in accordance with the referential data? (Relates to data provided to state authorities) <i>Example: Income tax return of the corporation that moved to new address and did not report the change to the tax office.</i>			
6	Accuracy	Accuracy of figures (In compliance with the limits constituted by a law or provision)			
7	Accordance with the data standard	Is there the data format standard for the given case? (XML, EDI, etc.) <i>Example: Tax administration portal (Ministry of Finance), Portal for farmers (Ministry of Agriculture)</i>			
8	Rate of accordance with the data standard	To which extent does the electronic data exchange application utilize the given standard? <i>Example: The compatibility of data files with the web application of the state office.</i>			

9	Application interoperability	Is the application interoperable with the other application? <i>Example: Data transfer from the enterprise information system of the farm in the Portal for farmers at the Ministry of Agriculture.</i>			
10	Objectivity	Give the data the real picture? <i>Example: Data in the Land Parcel Identification System (LPIS)</i>			
11	Authenticity of data	Is the data message authentic? (Is there the guaranty of authenticity of the document as the electronic signature or original paper document?) <i>Example: Electronic submission of social security</i>			
	Total score				

Source: Own source

Table 5: Evaluation form.

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