

The assessment of the information quality with the aid of multiple criteria analysis

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Available online 13 November 2007

Abstract

The virtual business work flow depends on the information quality (IQ) which is essential attribute of information. The IQ depends strongly on organization of the information system (IS) and how the information is processed. In our approach we incorporate the four-aspect representation of IQ: (1) intrinsic, (2) contextual, (3) representational, and (4) accessibility. These four-aspects are divided into several criteria at the next level of hierarchy. The weights, representing the relative importance of criteria, have been assessed by pair-wise comparisons made by group of experts. Based on discussion with experts, six alternative strategies, that could be used for improving the IQ, were designed. For each given criterion, the group of subjects revealed the opinion about the level of achievement of every alternative. The set of scores, assigned to the alternative by different subjects, formed the discrete distribution that is used for a comparison of alternatives with the aid of stochastic dominances. In analogy to the Electre I methodology, the simple algorithm for the aggregate evaluation of analyzed alternatives was proposed. The benefits of proposed approach were demonstrated in a case study of the semiconductor industry. The results of our study suggest, that in case of matured company, the external strategies, that point out to the information exchange and strategic networked alliance with customers and suppliers, are preferred to the internal ones. The latter ones might be of greater importance for the new set up or for a young company.

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Keywords: Multiple criteria analysis; Analytic hierarchy process (AHP); Stochastic dominance (SD); Information quality (IQ); Semiconductor industry

1. Introduction

The contemporary economic activity relies heavily on continuous innovation process. This is distinctly seen in case of high-technology industry. Due to the accelerated technological progress and increasing global economic competition, the information quality (IQ) has become a vital aspect of business activity. It is the basis for virtual business work flow. The importance of the problem and complexity of the information management led us to develop the methodology that might be useful in seeking the best way for set up/improvement of IQ in the enterprise.

Our study has adopted the (Wang and Strong, 1996) approach with four-aspect representation of information

quality: (1) intrinsic, (2) contextual, (3) representational, and (4) accessibility. Following the AHP approach, these aspects were divided into several criteria, which formed the next level of hierarchy. The relative importance of each criterion was assessed in the pair-wise comparisons made by group of experts. Using the triangular fuzzy numbers instead of crisp numbers allowed us to incorporate the uncertainty of human judgment in the model.

Based on the profound discussions with experts we were able to develop a set of strategies suitable for the set up/improvement of the IQ. Then, they were examined in view of all criteria. The assessment was performed by the group of specialists with different opinions. The distribution of these opinions is the basis of assessment that employs stochastic dominances.

The proposed methodology is based on the single aggregate index called here preference index. The final

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evaluation of each alternative depends on two parameters: preference threshold and demur threshold. In contrast to the Electre I approach, both parameters mentioned above are defined at the aggregate level.

We illustrated the proposed model of an evaluation and decision procedure with a case study of semiconductor industry. The remainder of the paper is organized as follows: Section 2 introduces the problem of the IQ. The hierarchical model of the IQ is presented in Section 3. Then we formulate six strategies which point out to the improvement of information process in an enterprise (Section 4). Section 5 presents a method of evaluation and a procedure that led to aggregated rating of alternative strategies. Section 6 contains the application of the model to the case study. Finally, summary and conclusions (Section 7) follow.

2. Information quality

Quality of information serves as the background for all steps in communication process in the modern enterprise: Establishing, opening and strengthening of communication channels. Relatively small businesses, which operate locally, have limited ability to access and utilize the large amounts of information. In such cases, managers mostly can operate their businesses relying mostly on their own experience. Large businesses, operating on global scale, need a well established information system as a basis for effective communication among various subjects involved in a business process.

IQ results from information system (IS) which covers the organizational processes, procedures, and roles employed in collecting, processing, distributing, and using data. Companies need to treat information as a product that ultimately serves as a tool to satisfy consumer needs. The opening communication channels put emphasis on the integrated form that companies need. Due to multiple functions within a well-structured organization, its databases reside in the larger context of specific requirements in functional departments. Therefore, the integrated platform (hardware or software or both) is necessary to help to align the information in order to transfer it into a useful knowledge to other departments or functions.

In general, companies do not have access to the existing data in the integrated form. Due to the fact that organizational databases reside in the larger context of information system, it is often referred to as a database or a computer system, including hardware and software, and it covers the organizational processes, procedures, and roles employed in collecting, processing, distributing, and using data. Companies need to treat information as a product, that is, as an deliverable end that satisfies consumer needs. Therefore, a product should be assessed at each step of operation. Besides, IQ should be defined by information consumers instead of providers or custodians of information, such as IT departments. IQ, defined from this perspective, can be used by researchers and practitioners to

direct their efforts to information consumers instead of the IS professionals.

Conventionally, information quality has been described as how accurate the information is. Wang and Strong (1996) identify IQ as encompassing multiple dimensions; managing the information as a product; capitalizing the knowledge as assets; and then to survive and prosper in the digital economy. Although, some of the dimensions are objective while others subjective; some are context independent and others context dependent. However, until today no standard information quality definition exists.

Many empirical studies on information quality that have been performed. Zmud (1978) considered the dimensions of information important to users of hard copy reports. Delone and Mclean (1992) reviewed the MIS (management information system) literature during 1980s, reporting 23 IQ measures. Ballou and Pazer (1985) study focuses on intrinsic dimensions, using accuracy, consistency, completeness and timeliness. Wang and Strong (1996) used a market research approach to determine the dimensions of importance to information consumers. Gardyn (1997) focused on attributes of IQ that were important to users, including correctness, completeness, consistency, currency, and accessibility. Lee et al. (2002) proposed a model that consolidated the dimensions into four quadrants: sound, useful, usable and dependable information.

During our surveys with experts, we found that Wang and Strong's IQ concept on quality information and knowledge has higher level of acceptance than other competitive concepts. Literature review accompanied by overview of practical problems that arise in the semiconductor industry suggested the Wang and Strong's four dimensional concept of IQ as the best suited to our practical application. However, it should be stressed that actual content, and in particular the number and structure of aspects and criteria are not essential to our model.

3. Hierarchical evaluation model

In our approach we incorporated the slightly revised¹ four-aspect representation of information quality proposed by Wang and Strong (1996). In the process of designing our assessment methods we followed the ideas employed in series of papers (Tzeng, 1977; Tzeng and Shiah, 1987; Tzeng et al., 1992; Tzeng and Teng, 1994). These practical applications have presented the ways of handling qualitative criteria in quantitative model, and have obtained quite reliable results.

According to the AHP procedure (Saaty, 1980, 2005) hierarchical structure was introduced. First, problem was broken into four evaluation aspects which form the second level of hierarchy: (1) intrinsic, (2) contextual, (3) representational, and (4) accessibility of IQ. Then each aspect was

¹ Following the experts' opinions revealed in interviews, the aspect accessibility was complemented by criterion convenience, which was not present in the original IQ dimensions of Wang and Strong.

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