A consensus support model based on linguistic information for the initial-self assessment of the EFQM in health care organizations

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ABSTRACT

The improvement of the quality of the services is one of the primary sources of competitive advantage in health care organizations. As customers typically search for higher quality of care when choosing treatments, health plans and providers, the health care organizations strive to improve the quality of care and patient safety and satisfaction, as primary goals, with the resources that are available. To do so, the European Foundation for Quality Management (EFQM) Excellence Model for self-assessment has been used by the health care organizations to improve their services and their competitiveness in the global market. However, when the health care organizations address self-assessment processes for the first time, the initial effort needed presents many difficulties. The aim of this paper is to offer a consensus support model based on linguistic information to conduct the self-assessment of the EFQM Excellence Model when questionnaires are used. It is based on the use of linguistic information to provide the individuals' opinions, which facilitates the individual responses, and on the use of fuzzy majority, represented by means of a linguistic quantifier, to compute the measures guiding the consensus reaching process.

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1. Introduction

Health care is not only the fastest growing service industry, both in the developed and developing countries, but it also impacts the well-being of people. Due to it, health care is receiving much attention around the world (Lee, 2012). As quality of care and service is a top priority, the health care organizations are continuously making efforts for improving quality of services and increasing business performance.

Some of today's primary discussion topics in health care are cost management, empowerment of patients, deregulation and competition between health care providers (Nabitz, Klazinga, & Walburg, 2000). The goal of the health care organizations is to achieve the highest quality of care possible with the resources that are available, even with limited medical equipment, human resources, finances, and others (Moeller, 2001; Nabitz et al., 2000). In this context, a new paradigm has emerged: quality management in health care, which is increasing the performance in the health care organizations and strengthening their progress.

One way to meet the challenges in creating a high performance organization in health care is the Excellence Model developed by the European Foundation for Quality Management (EFQM) to structure and review the quality management of an organization (Nabitz et al., 2000). This model has been widely used in almost all European countries by hospitals, out-patient care, rehabilitation clinics, acute care, primary and specialized care, and others (Nabitz et al., 2000; Sánchez et al., 2006; Vallejo et al., 2007).

Many health care organizations start to apply the EFQM Excellence Model by doing an initial self-assessment. The EFQM believes that the process of self-assessment is a catalyst for driving improvement and defines it as follows (EFQM, 2012):

> "Self-assessment is a comprehensive, systematic and regular review of an organization's activities and results referenced against the EFQM Excellence Model. The self-assessment process allows the organization to discern clearly its strengths and areas in which improvements can be made and culminates in planned improvement which are then monitored for progress."

Self-assessment can be carried out in different ways more or less complex, depending on the degree of maturity of the organization, knowledge of the model itself with the people who perform it, and the results being sought. EFQM proposes different approaches for self-assessment: the award simulation approach, the pro-forma approach, work meetings, questionnaires and improvement matrices (EFQM, 2012; Nabitz et al., 2000; Vallejo et al., 2007). All these approaches are valid, although the use of each of them entails advantages and disadvantages that have to be taken into account when choosing the medium to use.

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Among the different approaches proposed by EFQM, here we focus on the questionnaire approach, as it is the easiest way to perform self-assessment. Questionnaire approach is a team activity with the members of the evaluation team considering the organization's position against each question. Over the answer to a series of questions designed to observe the organization status, we can make a diagnosis of the organization and know what it is its behavior with respect to the Excellence Model. In such a situation, it is advisable that the members of the evaluation team carry out a consensus process (Cabrerizo, Alonso, & Herrera-Viedma, 2009, 2010a, 2010b; Herrera, Herrera-Viedma, & Verdegay, 1996b; Pérez, Cabrerizo, & Herrera-Viedma, 2010, 2011b; Tapia-Garcia, Moral, Martinez, & Herrera-Viedma, 2012; Xu & Cai, 2011), where they discuss and modify their opinions gradually to achieve a sufficient agreement before obtaining the score on each question. If this process is not carried out, it can lead scores that are not well accepted by some members in the group (Saint & Lawson, 1994), because they could consider that their opinions have not been taken into account properly to obtain the score and, hence, they might reject it. Therefore, the results obtained will be better if the score on each question is achieved by consensus among the members of the evaluation team.

The objective of this paper is to present a consensus support model based on linguistic information to conduct self-assessment processes of the EFQM Excellence Model in health care organizations when questionnaires are used. On the one hand, the usual way of implementing the Excellence Model is based on quantitative scales and all the measures are calculated in a numerical context. However, as the information provided by the humans is inherently non-numeric, partial evaluations, preferences, judgments, and weights are usually expressed linguistically (Chou, 2012; Alonso, Cabrerizo, Chiclana, Herrera, & Herrera-Viedma, 2009; Herrera, Alonso, Chiclana, & Herrera-Viedma, 2009; Pérez, Cabrerizo, & Herrera-Viedma, 2011a; Zadeh, 1975a, 1975b, 1975c). The use of words or sentences rather than numbers is, in general, less specific, more flexible, direct, realistic, and adequate form to express the qualitative aspects of the problem at hand. Therefore, in this model, we assume that the opinions are expressed by means of linguistic terms. On the other hand, we apply a consensus process to reach the possible maximum agreement on the answers given by the members of the evaluation team to each question. This consensus process is based on the idea of counting the number of individuals that are in agreement over the linguistic value assigned to each question, and the aggregation of that information under a fuzzy majority. To do so, the model uses two kinds of consensus measures (Herrera et al., 1996b, Herrera, Herrera-Viedma, & Verdegay, 1997): (i) *linguistic consensus degrees*, used to evaluate the current consensus existing among the members of the evaluation team, and (ii) *linguistic distances*, used to evaluate the distance of individuals' opinions to the group one. The joint use of both measures describes with a great detail the current consensus situation and allows obtaining collective decision with higher consensus on each question.

The paper is set out as follows. Section 2 presents the preliminaries of the consensus support model, i.e., the fuzzy linguistic approach for computing with words and the EFQM Excellence Model. Section 3 describes the consensus support model based on fuzzy linguistic information that we propose in this paper to conduct the initial self-assessment of the EFQM Excellence Model in health care organizations. Section 3 shows a practical example to illustrate the application of the model. Finally, some conclusions are pointed out in Section 5.

2. Preliminaries

In this section, we firstly introduce the fuzzy linguistic approach for computing with words. Afterwards, both the EFQM Excellence Model and the self-assessment process are described.

2.1. A fuzzy linguistic approach for computing with words

Many problems present fuzzy and qualitative aspects (Herrera et al., 2009). In such problems, information cannot be assessed precisely in a quantitative form but it may be done in a qualitative one, and thus, the use of a linguistic approach is necessary. The fuzzy linguistic approach is a technique appropriate to deal with fuzzy and qualitative aspects of problems. It models linguistic information by means of linguistic terms supported by linguistic variables (Zadeh, 1975a, 1975b, 1975c), whose values are not numbers but words or sentences in a natural or artificial language. A linguistic variable is defined by means of a syntactic rule and a semantic rule. The fuzzy linguistic approach is less precise than the numerical one, but, however it presents the following advantages: (i) the linguistic description is easily understood by human beings even when the concepts are abstract or the context is changing, and furthermore, (ii) it diminishes the effects of noise since, as it is known, the more refined assessment scale is, the more sensitive to noise is (linguistic scales are less refined than numerical scales and consequently they are less sensitive to error apparition and propagation).

The ordinal fuzzy linguistic approach is a kind of fuzzy linguistic approach very useful and used for modeling the linguistic aspects in the problems (Carlsson & Fuller, 1995; Herrera, Herrera-Viedma, & Verdegay, 1996a; Herrera-Viedma, Herrera, Martinez, Herrera, & López, 2004; Herrera-Viedma & López-Herrera, 2007; Porcel, Tejada-Lorente, Martinez, & Herrera-Viedma, 2012; Yager, 1993). It facilitates the fuzzy linguistic modeling very much because it simplifies the definition of the semantic and syntactic rules. This approach is defined by considering a finite and totally ordered label set $S = \{s_i\}$, $i \in \{0, \ldots, \mathcal{T}\}$, in the usual sense, i.e., $s_i \geqslant s_j$ if $i \geqslant j$. Typical values of cardinality used in the linguistic models are odd ones, such as 7 or 9, with an upper limit of granularity of 11 or no more than 13, where the mid term represents an assessment of "approximately 0.5", and the rest of the terms being placed symmetrically around it. These classical values seems to fall in line Miller's observation about the fact that human beings can reasonably manage to bear in mind seven or so items (Miller, 1956). The semantics of the linguistic term set is established from the ordered structure of the label set by considering that each linguistic term for the pair $(s_i, s_{\mathcal{T}-i})$ is equally informative. For example, we can use the following set of seven labels to provide the opinions: {N = Nothing, VL = Very Little, L = Little, E = Enough, M = Much, VM = Very Much, T = Totally}.

An advantage of the ordinal fuzzy linguistic approach is the simplicity and efficiency of its computational model for computing with words. It is based on the symbolic computation (Herrera et al., 1996a). This technique acts by direct computation on labels by taking into account the order of such linguistic assessments in the ordered structure of linguistic terms. This symbolic tool seems natural when using the fuzzy linguistic approach, because the linguistic assessments are simply approximations which are given and handled when it is impossible or unnecessary to obtain more accurate values.

Usually, the ordinal fuzzy linguistic model for computing with words is defined by establishing:

1. A negation operator, which is defined from the semantics associated to the linguistic terms as: $\text{Neg}(s_i) = s_j | j = \mathcal{T} - i$.
2. Comparison operators, which are based on the ordered structure of linguistic terms:
   - Maximization operator: $\text{MAX}(s_i, s_j) = s_i$ if $s_i \geqslant s_j$.
   - Minimization operator: $\text{MIN}(s_i, s_j) = s_i$ if $s_i \leqslant s_j$.
3. A distance operator, D, between linguistic labels s_i and s_j, which is computed as:

$$D(s_i, s_j) = s_k, \quad \text{where } k = \begin{cases} i - j & \text{if } i > j \\ j - i & \text{otherwise} \end{cases} \tag{1}$$