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A combined AHP–GP model for quality control systems

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Abstract

Using the results of previous studies of service quality attributes, five sets of quality measures are identified. These indicators or measures, through the analytic hierarchy process (AHP), are then accurately and consistently weighted. The priority weights are, in turn, incorporated in a goal-programming model to help select the "best" set of quality control instruments for customer data collection purposes. The paper proposes a decision aid that will allow weighting (prioritizing) of a firm's unique service quality measures, consider the real world resource limitations (i.e., budget, hour, labor, etc.), and select the optimal set of service quality control instruments. The paper addresses two important issues: how to incorporate and decide upon quality control measures in a service industry, and how to incorporate the AHP into the model. A real world case study illustrates the application of this combined analytic hierarchy process and goal-programming (AHP–GP) model.

Keywords: Analytic hierarchy process; Goal programming; Service quality

1. Introduction

A problem encountered in designing quality control systems for service organizations is the measurement of the quality construct. Schniederjans and Karuppan [1] developed a goal-programming model to aid in selecting the "best" set of quality control instruments in designing a quality control system. Goal programming is a procedure for handling multiple-objective situations within the general framework of linear programming. Each objective is viewed as a goal. Then, given the usual resource limitations or constraints, the decision-maker attempts to develop decisions that provide the "best" solution in terms of coming as close as possible to reaching all goals. Through a review of the literature they developed a list of indicators defining the quality construct. These indicators were, in turn, incorporated into a goal-programming model for the design of a quality control system in service organizations. A zero–one goal-programming model was developed to help select the best set of quality control instruments. They presented a small business application to implement the model. The model employed a scoring method to rate the instruments (on a scale from 1 to 10). A simple scoring method was used to establish the priorities for the quality measures with regard to each instrument.

One of the problems in any multi-objective method is the bias introduced by the initial solution provided by the selection process. The simple

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scoring method employed by Schniederjans and Karuppan is highly susceptible to such bias where there is a tendency to adjust biases and anchor upon initial points. Moreover, Tversky and Kahneman [2], and Steuer [3] raise the issue that when simple scoring methods are used, the decision-maker's consistency is not verified. This method does not provide consistency feedback to the decision-maker. Saaty [4] points out that while decision-makers theoretically are paragons of consistency, in practice humans have been known to change their mind, either through reconsideration, or through the process of learning. The analytic hierarchy process (AHP) has been proposed as a means of reconciling initial decision-maker's expression of preference, as well as means of identifying the consistency of that expression. It provides an estimate of additive utility weight that best matches the initial information provided by the decision-maker. Moreover, when the AHP is used to obtain an initial estimate of the priorities, the initial points are selected on the bases of pairwise comparison of alternatives. The effect of introducing bias is lessened [5].

Even though Schniederjans and Karuppan did not use the AHP, they recommended its use to more accurately weight the importance of the quality measures. The purpose of this paper is to extend the model presented by Schniederjans and Karuppan [1] by using the AHP method to aid in accurately representing the goal-programming (GP) model's objective function and quality measure goals. The paper will demonstrate how current limitations in decision-making involving selecting quality control instruments can be overcome by combining the AHP and GP. The use of the proposed model is illustrated in a real world case study.

1.1. Service quality attributes in literature

Early conceptualizations suggested several general service attributes that might be used to assess service quality. Sasser et al. [6] proposed three different dimensions of service performance: levels of material, facilities, and personnel. Gronroos [7] proposed two types of service quality: technical quality (what customers actually receive from the service provider), and functional quality (the manner in which customers receive the service). Lehtinen and Lehtinen [8] discussed three kinds of quality: physical, corporate, and interactive quality.

Although there has been an avalanche of publications on service quality attributes, only few provided attributes that are developed and tested scientifically. Garvin [9,10] proposed eight dimensions to measure quality. He did not discriminate between goods producing or service providing firms. The eight dimensions included performance, features, reliability, conformance, durability, serviceability, aesthetics, and perceived quality.

DeSouza [11] reported service quality attributes from the Profit Impact of Market Strategy (PIMS) database. There were 12 attributes: delivery, warranty, repair and maintenance, sales services, corporate viability, advertising and promotional material, customization, technical support, location, complaint handling, ordering and billing simplicity, and communications.

Parasuraman et al. [12] proposed 10 determinants of service quality that included reliability, responsiveness, competence, access, courtesy of personnel, communications, credibility or trustworthiness of the organization, security or protection from risk, understanding of customers' needs, and tangibles or physical elements attesting to the service. In a later study, these determinants were factor analyzed and generated five principal quality dimensions: tangibles, reliability, responsiveness, assurance, and empathy [13].

A consistent theme emerging from these dimensions is that customers might use more than just service outcome or "core" in assessing service quality. Customer assessment may also be influenced by the service process and the "peripherals" associated with the service. The research conducted by Parasuraman et al. [12] confirmed that both outcome and process dimensions influence customers' evaluation of service quality regardless of service sector. The 10 determinants of their study, and identified earlier, constitute a more comprehensive set of service quality dimensions. However, the researchers acknowledged the possibility of overlapping dimensions. Through extensive empirical research, using statistical and psychometric tests, they developed and refined the SERVQUAL instrument to focus on five principal quality dimensions, which