Chapter 1
Selection of Maintenance Strategies in an Operating Theatre

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ABSTRACT

The aim of this chapter is to select the most suitable combination of maintenance policies in the different systems that make up an operating theatre: air conditioning, sterile water, power supply, medicinal gases, and operating theatre lighting. To do so, a multicriteria model will be developed using the Measuring Attractiveness by a Categorical Based Evaluation Technique (MACBETH) approach considering multiple decision centres. The model uses functional, safety, and technical-economic criteria, amongst which is availability. Mean availability for repairable systems has been measured to assess this criterion, using Markov chains from the data obtained over three years from the subsystems of a hospital operating theatre. The alternatives considered are corrective maintenance; preventive maintenance together with corrective maintenance by means of daily, weekly, monthly, and yearly programmes; periodical predictive maintenance together with corrective maintenance; and corrective together with preventive and predictive maintenance.

INTRODUCTION

The most up-to-date hospitals are experiencing increasing automation and monitoring of installation and equipment and, in general, greater complexity in the assets to be maintained (Wolf, 2008). To adjust to this new environment, a hospital's technical services (including maintenance engineering, safety and environmental services) should adapt to modern strategies and management tools that have, in fact, already been operating for some time in the manufacturing, energy, etc. industries. Currently, due to

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the lack of structured criteria in hospital activity, it is normal to find different strategies and approaches to achieve similar ends with a great variety of costs and results. However, the activities carried out are essentially corrective and technical-legal (Fernández & Canals, 2006).

It is essential to analyse, from the qualities perceived by patients and healthcare professionals, the aspects that have a bearing on a hospital as a building answering to customer needs and increased safety. It is in these areas that the technical services have a predominant role, although there are deficiencies in recognizing the importance of maintenance management in hospitals (Rani, Baharum, Akber, & Nawawi, 2015). In general, users of the Spanish health system believe that the scientific-technical quality of its health professionals is excellent (SESCAM, 2007). They do not think the same about the other services, and particularly those regarding buildings, facilities, cleaning and those necessary for minimum comfort standards.

The application of a methodology such as that described in this research should therefore lead to a very significant change in the appreciation that people in general have of the technical services of the hospital responsible for carrying out maintenance.

Furthermore, health care professionals should be made aware of the situation of the facilities and equipment they use as internal users, as they need greater safety in their working environment. To do so, procedures should be established so that the condition of the equipment, facilities and working environment is precisely determined, and the staff need to be included in the assessment process.

The aim of this article is to select the most suitable maintenance policies in the different subsystems that make up an operating theatre. To do so, a multicriteria model is designed, using the Measuring Attractiveness by a Categorical Based Evaluation Technique (MACBETH) (Bana e Costa & Vansnick, 1994), considering multiple decision centres: managers from the Hospital's technical services, environmental and occupational risk prevention sections, healthcare managers (operating theatre and health activity programming), healthcare staff, technicians, purchasing managers and Hospital executives. The model uses safety, functional and technical-economic criteria, among which is availability. Mean availability for repairable systems has been measured to assess this criterion, using Markov chains from the data obtained over three years from the subsystems of a Hospital operating theatre. All this is aimed at increasing the operating theatre's availability and, consequently, increasing physical safety in patient operations and reducing the amount of delayed operations due to technical malfunctions.

Thus, the application of this research could lead to a significant increase in care quality, when carried out successfully in a state general hospital.

To choose the type of Multi-Criteria Decision Making (MCDM) to apply in this case study, it was felt that, given the multi-faceted profile of the decision-making groups, it should be easy to handle, intuitive, and respond to qualitative stimuli, without the need for the decision-making group to have to establish a numerical scale for subsystems. The choice of MACBETH is justified latter.

The originality of this chapter rests on the following points:

- The inclusion of the multicriteria technique MACBETH in group decision-making and its use with Markov chains in repairable systems to assess the availability of subsystems in the Hospital.
- It is the first research to analyse the selection of the best combination of maintenance policies, assessing all the systems which make up the operating theatre system. To this end the interrelations between the different systems of the Hospital were analysed.
- Although practical research on choice of maintenance policy in manufacturing companies has been done, this is one of the first studies that analyses this matter in a public service company