UTILIZATION OF THE MULTIPLE CRITERIA METHOD FOR EVALUATION OF THE PERFORMANCE OF PLANTS WITH RESPECT TO: SAFETY, ORGANIZATION AND CLEANLINESS – A Case Study

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ABSTRACT

The objective of this case study is to construct an evaluative model which measures the performance of a company's production plants in the diverse areas of a Program called SOL. The differential evaluation, covering only the aspects of safety, organization, and cleanliness in each work area; focuses on pertinent aspects of the control and prevention of accidents, the level of cleanliness and hygiene in the workplace, and the organization of equipment and tools, among others.

The educational and participative characteristics of the SOL Program ensure that the collaborator acts as a transforming agent towards the improvement of the work atmosphere, proportioning an increase in the level of internal harmony and a greater participation from the employees in the process of bettering their own working conditions.

This study utilizes the *Multiple Criteria Decision Aid* (MCDA) and establishes a model which ranks the plants that were analyzed in terms of performance concerning the overall implantation and execution of the SOL Program. It permits as well an individualized analysis per work area, enabling the identification of the less proficient.

The purpose of MCDA is to proportion support to the decision-maker in the process of choice among alternatives, thus inducing the generation of an optimal solution or some form of *ranking* of possible solutions based on preference. MCDA results from problems of *ranking* or selection from a series of possible alternatives of action in the presence of conflicting criteria.

This can be easily explained if we observe that in the majority of cases, in a decision-making problem we have innumerable factors which effect the situation at hand, and very likely, upon being considered, themselves privilege different paths towards and thus options for a solution.

***M**easuring **A**ttractiveness by a **C**ategorical **B**ased **E**valuation **T**echnique* (**MACBETH**)- developed by Carlos A. Bana and Costa and Jean-Claude Vansnick will be used equally to construct scales of cardinal attractiveness about a point of view (modeling of local preferences), as in reflection, hoping to determine the coefficients of reflection among various points of view and identified areas of interest.

The system adopted based itself on the establishment of three levels in each criterion and on the direct scoring of each of these levels, receiving a value of zero for the worst ranking, three for an intermediate ranking and five for the best potential action within the criteria. The final evaluation of each sector of the business is based upon the compilation of results obtained in

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each criterion. In function of the value obtained, the sector is classified as either good, regular (average), or bad.

Within the three evaluated areas, twelve fundamental points of view (FPV) were structured: four Safety, five Organization, and three Cleanliness. They were; Number of accidents in the last month, Use of EPIs, Unsafe conditions, and Investment plans for the Safety area; Warning signs of the quality square, Signalization, Use of uniforms, Materials in use in the work area, and Materials not in use in the work area for the Organizational area; and Personal aspects, Waste, and Work space for the Cleanliness area.

After the construction of the describing factors of each FPV, the matrixes of preference judgments were established by means of binary relationships between the impact levels of each point of view. These matrixes are constructed through the evaluation pair by pair of the potential actions of the decision-maker, based upon the scale of difference of semantic attractiveness established in the MACBETH methodology. The transformation of the semantic matrix into a numeric scale, an intrinsic procedure to the method generates the value scale.

Once the elementary and thus fundamental points of view were elaborated, the structure was fed into the *Hiview software*.

In the application of the evaluation model presented, six plants were analyzed with respect to development of the SOL Program.

The way in which the model was constructed, one can develop analyses as much in the overall sense as in specificities for each of the areas involved in SOL, identifying, beyond the overall performance of the factories, the areas which represent satisfactory performance and principally, those most in need of greater efforts in order to improve the overall performance. In a Value vs. Plants graph, for example, we can see each plant's bar as the vertical composition of Safety, Organization, and Cleanliness.

The model in question ensures that it provides a measurement of the performance of each plant, and identifies the deficient areas, as well as the critical factors which most contribute to the cause of such performance. It also ensures the identification of the aspects which most contribute to the performance in the best-ranked areas and plants, offering direction to the worst-ranked in the search for improvement in future results.

After the application of the MCDA, through an analysis of sensitivity, it is possible to verify, by the variation of rankings, the impact on the local and overall performance of the plants.

One may conclude, in the general sense, that the model developed, based upon the MCDA, is of great importance, for beyond evaluating the performance of each factory, it permits that upon situating the most efficient, the plants of unfavorable performance have a parameter on which to base their future performance in each area, and more specifically, in each factor involved. And still, the MCDA permits that not only quantitative factors are incorporated and evaluated, but qualitative factors are as or even more important, allowing the decision-maker to utilize his/her value system related to the problem in question.

The evaluation model of the SOL Program of the business in question is based upon criteria identified in terms of their implantation, by the team of evaluators made up of representatives of diverse sectors of the company. A model elaborated as such permits a better understanding of the problems related to the areas of safety, organization, and cleanliness and will proportion facts and data which will orient the control and prevention of factors which put at risk the well-being of its contributors and the satisfactory performance of organizations.