

Habilitation Thesis

RESEARCH AND CONTRIBUTIONS IN QUALITY MANAGEMENT AND ENGINEERING

- ABSTRACT -

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The habilitation thesis presents the results of the scientific research and didactic activities performed at the “Petru Maior” University of Tirgu Mures and carried out after obtaining the scientific title of doctor (April 1996). As it is natural, the two central elements are related, therefore the didactic and research activities have focused especially on quality management and parallel mechanisms, but there have also been preoccupations in other domains specific for industrial engineering and management.

The habilitation thesis contains, in section I, SCIENTIFIC, PROFESSIONAL AND ACADEMIC ACCOMPLISHMENTS, ten sub-chapters dedicated to the presentation of the most relevant achievements in the above mentioned directions.

Therefore sub-chapter 1.1. “Quality assurance in higher education”, investigates the relationship between total quality management and strategic issues, of the way to implement quality management systems in universities. I have defined a strategy for integrating quality which has a central role in the competitive strategies, believing that the balance of determination is the opposite of the traditional. I have applied the model with its novelty aspects to a case study, showing how it is applied the defensive strategy.

Sub-chapter 1.2. “Quality assurance and sustainable assessment in the vocational education and training” demonstrate a new and innovative approach to assessing organizations institutional sustainability in terms of five key pillars: institutional capacity, environmental, economic, social, and training provision. In the five areas of the proposed new and original sustainability assessment framework, a total of 40 performance indicators are used to make the assessment. The assessment process is based on a novel approach for the couple values for performance and importance of the indicators, by using scales from 1 to 5 for both.

Sub-chapter 1.3. “Innovative tools and models for elearning in Romania” reports results from the Move-it project, examples from new, ongoing distance learning activities that utilize state of the art digital media, tools and methods. The design of video infrastructure in the video room is presented. The model for interactive distance learning as a natural extension of the traditional educational environment is

developed as a new educational technology for the master degree in Quality Management.

Sub-chapter 1.4. “VET course design in quality management” presents some results of the project TIT-us. It addresses to the need of designing new Vocational Education and Training courses for training in quality management qualifications. I have shown that each activity in VET is a quality approach which consists of a number of decisions made within the five steps: plan, do, check, act and a certain methodology. The pedagogical methodology for training of quality professionals employs new developments of Activity Based Training (ABT) and Student Response System (SRS).

Sub-chapter 1.5. “Green methodology for evaluation” presents a peer learning approach as a result of the eQvet-us project, which creates a green learning arena by employment of peer assessment, a new methodological approach in 5 steps. The new eQvet-us training outcome evaluation model developed, consist in an improvement of the Kirkpatrick’s model by associating to the evaluation level the corresponding objectives. In this way two levels are deduced, that are following the PDCA cycle in opposite senses.

Sub-chapter 1.6. “Quality methods employed for product design” demonstrates application of quality function deployment (QFD) approach and knowledge management in order to understand the customer needs and to select suitable characteristics and their “weights”, for a new product design, in a mineral water company. This knowledge is used to develop a new product, enabling the company to enter the new markets successfully. The presentation shows how achieved experience and continuous improvement are parts of the knowledge management, which fits into the QFD project.

Sub-chapter 1.7. “Parallel mechanisms” presents the 6-PGK innovative structure of a spatial parallel mechanism with 6 degrees of freedom and a method to determinate a desired trajectory for the manipulated object, with an imposed velocity, when some vibration motions act in the prismatic motor joints. By using the Lagrangian approach the dynamic equations of motion of the parallel robot are deduced and the supplementary generalized forces that must be introduced in system in order to correct the trajectory errors are computed from these equations.

Sub-chapter 1.8. “Performance evaluation of the 6-PGK parallel mechanism” evaluates of the mechanism and aids the design process via the analysis of maximum force in all direction index and actuator force index. It allows all the actuators of the manipulator to be compared on the same dimensionless scale and to select it properly in the design process. Four sets of test are performed on the most common trajectories used in industrial applications consisting in linear and circular motions. The results and the developed software for numerical simulation assist the designer in the process of developing the parallel robot manipulator.

Sub-chapter 1.9. “ANN based inverse dynamic model of the 6-PGK parallel robot manipulator” presents an inverse dynamic model estimation based on an artificial neural network. By implementing feedforward artificial neural networks as a nonlinear autoregressive model with exogenous inputs, it is investigated the possibility of choosing the optimum parameters that characterize the neural network so that it approximates as better as possible the model of the 6-PGK prototype robot. Finally an

innovative algorithm is developed for obtaining the optimal configuration parameters set of the feedforward artificial neural network.

Sub-chapter 1.10. “Parallel mechanism with six degrees of freedom for robots construction” presents the author invention which refers to a spatial parallel mechanism with six degrees of freedom that can be used for parallel robots construction, intended for handling or processing operations.

The second section **PLANS FOR THE EVOLUTION AND THE DEVELOPMENT OF THE PROFESSIONAL, SCIENTIFIC AND ACADEMIC CAREER**, based on the synthesis of the scientific and didactic achievements, presents a set of principles underlying the activity, the directions of the professional development as well as the concrete elements which contribute to their being carried out in future. The future development directions are detailed on concrete scientific domains, also presenting the expected results. Future plans related to international collaboration and the programs with national and international funding are highlighted.

Section III. **REFERENCES** include the list of associated bibliographical references used in the habilitation thesis.