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A New Curriculum for Manufacturing & Industrial Engineering and Engineering Management for BS and MS Degrees

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Abstract

This paper deals with the design and implementation of a new Curriculum for Manufacturing & Industrial Engineering and Engineering Management for Bachelor and Master Degrees at Tlemcen University, Algeria. This Curriculum aims to give to the student a multidisciplinary knowledge in the domain of Engineering, technology as well as management. The implementation of this curriculum at Tlemcen University has showed a large improvement of student skill that permits it to become a national curriculum.

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Keywords: manufacturing engineering; industrial engineering; engineering management; bachlor degree; master degree; curriculum; technology education; engineering education.

1. Introduction

In the last decades, a huge amount of new discoveries were noticed in technologies used in industry. As a sample example, programmable logic controllers (PLCs) that transformed completely the way industrial systems are controlled. At the same time, the ways these industries were managed were completely changed. New methods and techniques were developed to optimize the use of equipment, improve quality and reduce cost and delay. Due to these facts, industries asked for new skills for engineers: industrial engineering and more recently engineering management curricula were developed to fulfill these requests. Unfortunately, in many cases these

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curricula do not include technology skills and are devoted exclusively to managerial skills (operation and project management, quality and maintenance management, supply chain management...).

In Algeria, technology and managerial skills are very seldom found in the same curriculum. However, it was noticed in Algerian industries that technology engineers (electrical, mechanical, process...) have lacks in managerial skills that force them to get extra special trainings during their work time. These trainings cost a lot of money for companies (especially very small ones that have less than five engineers in their staff). On the other hand, Engineers coming from industrial engineering curriculum, have very low skills in technologies that they are supposed to control and manage. So they are rarely hired in small companies, because these companies cannot hire two engineers (technology and managerial) for one job. In Algeria, there exist about six hundred thousand companies; half of them work in industry. Among these companies, more than 95% have less than five engineers in their staff. Hence, it was necessary to imagine a new curriculum that can contain different skills that fit the very small companies' needs. These needs can be summarized in the following:

- Good skills in managing technology
- Good skills in managing human and financial resources
- Good skills in different type of technologies.

First of all, it was necessary to identify which kinds of technologies were most frequently encountered in industry. In nowadays, all industrial equipments need mechanical and electrical technologies. These equipments are, in most cases, computer controlled. In Algeria, most of industrial companies deal with process industry (food, oil and gas, detergent, cosmetics, pharmaceutical...). Another study of industry in Algeria showed bad performances in supply chain, production, quality insurance and maintenance and safety. Once these problems identified, curricula in Algerian universities and colleges were studied, it was noticed that no one was able to overcome all identified problems. Hence it was necessary to develop a new curriculum that can fulfill some or all of these needs. First of all, the new curriculum should include technological and managerial skills. For technological knowledge, electrical, mechanical and process engineering are needed as well as automatic control and computer sciences. So these fields of knowledge were included in the new curriculum. For managerial skills, operation and project management, quality and maintenance management, supply chain management as well as knowledge in system engineering and engineering management are integrated in the new curriculum.

Many work on how engineering, technology as well as their management should be thought can be found in the literature. We present in the following few of them. Cherrington [1] described a graduate program in Manufacturing Systems designed by the faculty of the University of Texas at Dallas and a fourteen member industrial advisory committee using a top-down approach. The curriculum is composed of nine required courses organized under the categories of manufacturing processes, process control, computer systems, product design, manufacturing systems, and business principles. A manufacturing project caps off the curriculum. Mason [2] presented the results on an industry survey that aimed, through 47 manufacturing companies comments and recommendations, to determine what are the most important skills that manufacturing engineers need to fulfill current and future practices. It was noticed through this survey that the most important skills were in manufacturing processes, economics, resource management and computer networking. Todd et al. [3] showed the importance of the manufacturing enterprise and the need for manufacturing education. They presented approaches for achieving manufacturing-related education, and stated that Mechanical Engineering and Industrial Engineering are often most closely associated with manufacturing. They encouraged new manufacturing programs along with review of educational content in traditional engineering disciplines-especially the related discipline of mechanical engineering. Their analysis leads them to believe that manufacturing represents a strategic direction and opportunity for engineering education to pursue. Swarengen, et al.[4] summarized industry updates on manufacturing engineering education, especially as they pertain to undergraduate engineering education for a globalized economy, and synthesized with the literature on the subject. They derived objectives for manufacturing engineering education and proposed ways of introducing the subject into an

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