Chapter 16
Decision Making Approaches for Advanced Manufacturing Technology Evaluation and Selection

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ABSTRACT

Advanced Manufacturing Technology (AMT) constitutes one of the most important resources of manufacturing companies to achieve success in an extremely competitive world. Decision making processes for the Evaluation and Selection of AMT in these companies must lead to the best alternative available. Industry is looking for a combination of flexibility and high quality by doing significant investments in AMT. The proliferation of this technology has generated a whole field of knowledge related to the design, evaluation and management of AMT systems which includes a broad variety of methodologies and applications. This chapter presents a theoretical review of the term AMT, its diverse classification and a collection of the most effective multi-attribute models and methodologies available to support these processes. Relevant advantages are found in these models since they can manage complex decision making problems which involve large amount of information and attributes. These attributes frequently can be tangible and intangible when vagueness and uncertainty exist. There are several multi-attribute methodologies which are extensively known and used in literature; nevertheless, a new fuzzy multi-attribute axiomatic design approach is explained for an ergonomic compatibility evaluation of AMT.

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INTRODUCTION

Definition of Technology

The term technology, of Greek origin, is formed by the word tekne ("art, technical or trade") and logos ("group of knowledge") and is used to define the knowledge needed to manufacture objects and modify the environment, with the aim of satisfying human needs.

According to the Spanish Royal Academy, technology is the set of theories and techniques that enable the practical use of scientific knowledge. It should be noted that, in the wrong form, the word technology is used as a synonym for information technology, which is the one that allows the processing of information by artificial means, which includes everything related to computers.

While it is difficult to establish a same schema for the different applications of the technology, one could say that the manufacture of an innovative device begins with the identification of a practical problem to solve. Then, the requirements to be met by the solution are established (materials, costs, etc.) and its operation principles. Finally, the new device is designed, built a prototype and its manufacture. Technology, therefore, covers this process, from the initial idea to its implementation in particular.

By itself, technology is neither good nor bad. Often, references of the positive impacts are the fact of increasing the productivity of human labor and the life's quality of population, with the decline of the efforts entailed. In its negative aspect, the technology can generate unemployment (the man is replaced by machines), social differences (workers are categorized according to their technological knowledge) and contamination of the environment. In society, technology is a result of science and engineering, although many technological advances are subsequent to these two concepts.

Currently, the market and competition in general, demand new technologies continuously in different areas of application (edge technology), assisted often by large global technology transfer (Holmes, 2009; Bubela & Caulfield, 2010).

These areas of application frequently create divisions between different fields, for example, to refer to a farm tractor it is called agricultural technology, to talk about technologies used in the classrooms it is known as educational technologies, etc. In this case, manufacturing applications of modern technology in production systems is identified as Advanced Manufacturing Technology; some further definitions are described.

ADVANCED MANUFACTURING TECHNOLOGY (AMT)

Manufacturing is one of the main activities that support the economy on any industrialized country. For Rao and Deshmukh (1997), manufacturing is the application of mechanical, physical, and chemical processes to modify the geometry, properties and appearance of a given material in the making of new, finished parts or products. In this matter, Advanced Manufacturing Technology is now a complete field of knowledge which implies the design, utilization and management of computer based equipment for manufacturing purposes.

AMT can be defined as the family of technologies that include: computer aided design, engineering systems, planning of resources systems, loading systems of automated materials, robots, machines of numerical control, flexible manufacturing systems and manufacturing integrated computer systems (Zammuto & O’Connor, 1992).

Other definitions are more concise, such as the one given by Raafat (2002) that recognizes AMT as the technological auxiliaries that have an effect on production systems, as:

- Automation services of storage.
- Flexible Manufacturing Systems (FMS).
- Improvement of assembly lines.
- Computer Aid Manufacturing (CAM).