



FIGURE 1.1 Two ways to define manufacturing: (a) as a technical process, and (b) as an economic process.

Manufacturing is almost always carried out as a sequence of operations. Each operation brings the material closer to the desired final state.

Economically, *manufacturing* is the transformation of materials into items of greater value by means of one or more processing and/or assembly operations, as depicted in Figure 1.1(b). The key point is that manufacturing *adds value* to the material by changing its shape or properties, or by combining it with other materials that have been similarly altered. The material has been made more valuable through the manufacturing operations performed on it. When iron ore is converted into steel, value is added. When sand is transformed into glass, value is added. When petroleum is refined into plastic, value is added. And when plastic is molded into the complex geometry of a patio chair, it is made even more valuable.

The words *manufacturing* and *production* are often used interchangeably. The author's view is that production has a broader meaning than manufacturing. To illustrate, one might speak of "crude oil production," but the phrase "crude oil manufacturing" seems out of place. Yet when used in the context of products such as metal parts or automobiles, either word seems okay.

## 1.1.2 MANUFACTURING INDUSTRIES AND PRODUCTS

Manufacturing is an important commercial activity performed by companies that sell products to customers. The type of manufacturing done by a company depends on the kind of product it makes. Let us explore this relationship by examining the types of industries in manufacturing and identifying the products they make.

**Manufacturing Industries** Industry consists of enterprises and organizations that produce or supply goods and services. Industries can be classified as primary, secondary, or tertiary. *Primary industries* cultivate and exploit natural resources, such as agriculture and mining. *Secondary industries* take the outputs of the primary industries and convert them into consumer and capital goods. Manufacturing is the principal activity in this category, but construction and power utilities are also included. *Tertiary industries* constitute the service sector of the economy. A list of specific industries in these categories is presented in Table 1.2.

This book is concerned with the secondary industries in Table 1.2, which include the companies engaged in manufacturing. However, the International Standard Industrial Classification (ISIC) used to compile Table 1.2 includes several industries whose production technologies are not covered in this text; for example, beverages, chemicals, and food processing. In this book, manufacturing means production of *hardware*, which ranges from nuts and bolts to digital computers and military weapons. Plastic and ceramic

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**Emerging Solutions for Future Manufacturing Systems** Luis M. Camarinha-Matos,2006-01-04 Industries and particularly the manufacturing sector have been facing difficult challenges in a context of socio economic turbulence characterized by complexity as well as the speed of change in causal interconnections in the socio economic environment In order to respond to these challenges companies are forced to seek new technological and organizational solutions In this context two main characteristics emerge as key properties of a modern automation system agility and distribution Agility because systems need not only to be flexible in order to adjust to a number of a priori defined scenarios but rather must cope with unpredictability Distribution in the sense that automation and business processes are becoming distributed and supported by collaborative networks Emerging Solutions for Future Manufacturing Systems includes the papers selected for the BASYS 04 conference which was held in Vienna Austria in September 2004 and sponsored by the International Federation for Information Processing IFIP

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**Standards for Engineering Design and Manufacturing**

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*McGraw-Hill Concise Encyclopedia of Engineering* McGraw Hill, 2005-06-15 Hundreds of well illustrated articles explore the most important fields of science Based on content from the McGraw Hill Concise Encyclopedia of Science Technooogy Fifth Edition the most widely used and respected science reference of its kind in print each of these subject specific quick reference guides features Detailed well illustrated explanations not just definitions Hundreds of concise yet authoritative articles in each volume An easy to understand presentation accessible and interesting to non specialists A portable convenient format Bibliographies appendices and other information supplement the articles

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