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 kinds of products it makes.

Manufacturing Industries Industry consists of enterprises and organizations that

produce or supply goods and services. Industries can be classiﬁ ed as primary , second-

ary, or tertiary. Primary industries cultivate and exploit natural resources, such as

agriculture and mining. Secondary industries take the outputs of the primary indus-

tries and convert them into consumer and capital goods. Manufacturing is the prin-

cipal activity in this category, but construction and power utilities are also included.

Tertiary industries constitute the service sector of the economy. A list of speciﬁ c

industries in these categories is presented in Table 1.2.

Primary Secondary Tertiary (service)

Agriculture Aerospace Food processing Banking Insurance

Forestry Apparel Glass, ceramics Communications Legal

Fishing Automotive Heavy machinery Education Real estate

Livestock Basic metals Paper Entertainment Repair and

Quarries Beverages Petroleum reﬁ ning Financial services maintenance

Mining Building materials Pharmaceuticals Government Restaurant

Petroleum Chemicals Plastics (shaping) Health and medical Retail trade

Computers Power utilities Hotel Tourism

Construction Publishing Information Transportation

Consumer appliances Textiles Wholesale trade

Electronics Tire and rubber

Equipment Wood and furniture

Fabricated metalsTABLE • 1.2 Speciﬁ c industries in the primary, secondary, and tertiary categories.

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This book is concerned with the secondary industries in Table 1.2, which include

the companies engaged in manufacturing. However, the International Standard

Industrial Classiﬁ cation (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 weap-

ons. Plastic and ceramic products are included, but apparel, paper, pharmaceuticals,

power utilities, publishing, and wood products are excluded.

Manufactured Products Final products made by the manufacturing industries

can be divided into two major classes: consumer goods and capital goods. Consumer

goods are products purchased directly by consumers, such as cars, personal comput-

ers, TVs, tires, and tennis rackets. Capital goods are those purchased by companies

to produce goods and/or provide services. Examples of capital goods include aircraft,

computers, communication equipment, medical apparatus, trucks and buses, railroad

locomotives, machine tools, and construction equipment. Most of these capital goods

are purchased by the service industries. It was noted in the introduction that manu-

facturing accounts for about 12% of gross domestic product and services about 75%

of GDP in the United States. Yet the manufactured capital goods purchased by the

service sector are the enablers of that sector. Without the capital goods, the service

industries could not function.

In addition to ﬁ nal products, other manufactured items include the materials,

components, tools, and supplies used by the companies that make the ﬁ nal products.

Examples of these items include sheet steel, bar stock, metal stampings, machined

parts, plastic moldings and extrusions, cutting tools, dies, molds, and lubricants.

Thus, the manufacturing industries consist of a complex infrastructure with vari-

ous categories and layers of intermediate suppliers with whom the ﬁ nal consumer

never deals.

This book is generally concerned with discrete items —individual parts and

assembled products rather than items produced by continuous processes . A metal

stamping is a discrete item, but the sheet-metal coil from which it is made is continu-

ous (almost). Many discrete parts start out as continuous or semicontinuous prod-

ucts, such as extrusions and electrical wire. Long sections made in almost continuous

lengths are cut to the desired size. An oil reﬁ nery is a better example of a continuous

process.

Production Quantity and Product Variety The quantity of products made by a

factory has an important inﬂ uence on the way its people, facilities, and procedures

are organized. Annual production quantities can be classiﬁ ed into three ranges: (1)

low production, quantities in the range 1 to 100 units per year; (2) medium produc-

tion, from 100 to 10,000 units annually; and (3) high production, 10,000 to millions

of units. The boundaries between the three ranges are somewhat arbitrary (author’s

judgment). Depending on the kinds of products, these boundaries may shift by an

order of magnitude or so.

Production quantity refers to the number of units produced annually of a particu-

lar product type. Some plants produce a variety of different product types, each type

being made in low or medium quantities. Other plants specialize in high production

of only one product type. It is instructive to identify product variety as a parameter

distinct from production quantity. Product variety refers to different product designs

or types that are produced in the plant. Different products have different shapes and

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sizes; they perform different functions; they are intended for different markets; some

have more components than others; and so forth. The number of different product

types made each year can be counted. When the number of product types made in

the factory is high, this indicates high product variety.

There is an inverse correlation between product variety and production quantity

in terms of factory operations. If a factory’s product variety is high, then its produc-

tion quantity is likely to be low; but if production quantity is high, then product vari-

ety will be low, as depicted in Figure 1.3. Manufacturing plants tend to specialize in a

combination of production quantity and product variety that lies somewhere inside

the diagonal band in Figure 1.3.

Although product variety has been identiﬁ ed as a quantitative parameter (the

number of different product types made by the plant or company), this parameter is

much less exact than production quantity because details on how much the designs

differ are not captured simply by the number of different designs. Differences

between an automobile and an air conditioner are far greater than between an air

conditioner and a heat pump. Within each product type, there are differences among

speciﬁ c models.

The extent of the product differences may be small or great, as illustrated in the

automotive industry. Each of the U.S. automotive companies produces cars with two

or three different nameplates in the same assembly plant, although the body styles

and other design features are virtually the same. In different plants, the company

builds heavy trucks. The terms “soft” and “hard” might be used to describe these

differences in product variety. Soft product variety occurs when there are only small

differences among products, such as the differences among car models made on the

same production line. In an assembled product, soft variety is characterized by a

high proportion of common parts among the models. Hard product variety occurs

when the products differ substantially, and there are few common parts, if any. The

difference between a car and a truck exempliﬁ es hard variety.