Chapter 1

Introduction to Smart Manufacturing: Value Chain Perspective for Innovation and Transformation

Zongwei Luo
The University of Hong Kong, China

ABSTRACT

Fast advances in information technology (RFID, sensor, Internet of things, and the Cloud) have led to a smarter world vision with ubiquitous interconnection and intelligence. Smart manufacturing refers to advanced manufacturing with wise adoption of information technologies throughout end to end product and service life-cycles, capturing manufacturing intelligence for wise production and services. It represents a field with intense competition in this century of national competitiveness. In this chapter, an introduction to smart manufacturing innovation and transformation is presented. An example is used to illustrate what is happening in China’s manufacturing industry, with insights about China’s strategy of advanced manufacturing research and development. The chapter emphasizes the value chain analysis for setting smart manufacturing strategies. A case study is conducted in detail to showcase a value chain analysis of RFID enabled SIM-smart card manufacturing for China’s mobile payment industry.

1. INTRODUCTION

Manufacturing in recent decades has made amazing progress. At present, manufacturing has adopted and leveraged more and more the latest achievements in materials, mechanics, physics, chemistry, and computer simulation technology, network technology, control technology, nanotechnology, biotechnology, and sensor technology. New manufacturing mechanism, manufacturing tools, processes and equipment continue to emerge. Manufacturing as a technology has developed into a new engineering science subject- Manufacturing Science. Cross-regional distribution of manufacturing resources in the era
of economic globalization, has forced manufacturing collaboration a daily necessary means. The networked collaborative tools and systems are also increasingly rich. Intelligent Manufacturing has been recognized as the direction of manufacturing technology innovation, the maturity of the related theories and technologies will be one of the signs of the advent of knowledge economy (Luo, 2013).

Advanced manufacturing’s role as the backbone of a country has been re-recognized and has aroused wide attention of major developed and developing countries. These countries have already started a series of advanced manufacturing technology research programs. Europe and the United States proposed “re-industrialization” in recent years to seize the commanding control of global industrial technology, and to further capitalize on the high-end manufacturing. In the U.S., President Barack Obama has announced infrastructure and technology policy and steps to restore the center of manufacturing in the U.S. Economy (Curtis, 2013). In the face of fierce international competition in the 21st century, Chinese government has planned accordingly and launched a series of major and key projects, carrying out special studies in the frontier of advanced manufacturing technology and equipment.

In this chapter, an introduction to smart manufacturing innovation and transformation is presented. An example is used to illustrate what is happening in China’s manufacturing industry, with analysis of China’s strategy of advanced manufacturing research and development. Emphasis is put upon value chain analysis for setting smart manufacturing strategies. In this context a case study is conducted in detail to show case a value chain analysis of smart card manufacturing for China’s mobile payment industry.

Organization of this chapter is as follows. Section 2 is devoted to an introduction to manufacturing for China, especially on manufacturing restructuring and opportunities. Section 3 is presented to introduce smart manufacturing research. Research trend of digital manufacturing, service manufacturing and intelligent manufacturing is discussed in detail. Section 4 is focused on smart manufacturing research agenda and fields. Section 5 introduces a case study of smart card manufacturing in China. Section 6 presents smart card value chain analysis for China’s mobile manufacturing industry. Section 7 concludes the chapter with manufacturing strategies discussions.

2. MANUFACTURING FOR CHINA

2.1 Cornerstone of China’s National Economy

The manufacturing industry is one of the pillar industries of China’s national economy, the carrier for science and technology development and a bridge to productivity conversion. In 2010, China’s share of global manufacturing output rose to 19.8 percent. Comparing with 19.4 percent of the U.S., China has become the world’s manufacturing superpower. With over 200 kinds of industrial products output as well as export ranking top one in the world, China has become a truly big manufacturing center of the world. However, there exists a considerable gap in China’s manufacturing technology and equipment manufacturing capacity, compared with other manufacturing powers in the world. Many of research and development activities are visible in the area of advanced manufacturing theory and technology. Research institutes and universities are sought for providing the source of innovation for the production of China’s manufacturing equipment to break through the blockade of high end manufacturing technologies by developed countries. This is of great significance in helping ensure national security and sustain healthy and stable development for China. Furthermore efforts are needed to carry out cutting edge research and development in smart manufacturing with aims to further expand and deepen the manufacturing technology innovation, help China develop into a high end manufacturing power, accelerate the transform from “Made in China” towards “Created in China.”