Chapter 8
Analyzing Inter-Firm Manufacturing for a Circular Economy and Green Supply Chain Management

Balaji Gopalan
https://orcid.org/0000-0002-1082-5597
CMS Business School, Bangalore, India

Rupesh Kumar Sinha
CMS Business School, Bangalore, India

V. Vinoth Kumar
https://orcid.org/0000-0002-8282-6740
CMS Business School, Bangalore, India

ABSTRACT

There has been a paradigm shift in how businesses manufacture products. Inter-firm manufacturing is a relatively new paradigm. This paper examines inter-firm manufacturing and presents an analytical framework in the light of a circular economy and green supply chain management. In developed countries, industry leadership is associated with manufacturing. Industry leaders are taking measures to encourage and prioritize manufacturing and establish new economies and business ecosystems across various industry sectors. This may be in the area of Information and communication technologies, pharma industries, 3D printing, food industries, housing, energy and utilities, businesses and financial services, and media. Today, various industries are shifting towards eco-friendly and sustainable businesses that align with circular economies and green supply chain management. For that purpose, a different analysis, one that associates performance metrics with an exergy analysis of industries in alignment with a circular economy and green supply chain management is necessary.

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INTRODUCTION

Manufacturing around the world depends on the optimization of costs and profits, logistics and supply chain management, product portfolio management and standardization. Manufacturing is a way to improve economic growth rates for countries. Making of products and services in the internet economy is going through phenomenal transformations. Technology has the capacity to significantly transform the designing and manufacturing of products. It also has the capacity to transform various service sectors. The business ecosystem of product accessories and product portfolio management are also supported by numerous small and medium industries. Many research publications have been written on the technology transformation of products and services e.g., transformative, frugal and reverse engineering (Wooldridge, 2010; Christensen, 1997; Raynor and Christensen 2003; Immelt et al., 2009).

Technologies and inventions have resulted in the creation of new products, upgrades, new processes and services that add economic value or good. New material sciences for additive manufacturing (AM), new AM methods and sensor integration into products are also recent advancements. Advanced composites in material science with enhanced performance are now being used in weight-sensitive applications in the aerospace industries, automobile industries and sports equipment (Spowart et al., 2018). Brands like Nike have involved customers on NikeID, an online shopping portal that lets customers customize shoe designs before purchase. Nike also encourages customers to generate ideas on product improvements and customization of Nike products. iPod sports kits and sensors have been used in Nike shoes for workout-based voice feedback and songs to motivate runners. Lego toys is another example of how value co-creation has facilitated and sourced customer's independent creativity and fanbase for co-creativity and mass customization of Lego products on its websites. It has even encouraged youngsters in the age group of 4-12 year olds to engage in the customization and personalization of products for manufacturing of their co-designs (Roser et al., 2009). In the challenge of the product design process, production teams successfully resolved (1) identification and selection of the raw materials, (2) selection of technologies, (3) prototype production, (4) testing, (5) preparation of quality management procedures and documentation, (6) design of the production technology, (7) supply chain and logistics systems management, (8) making of the transport and storage equipment, and (9) outsourcing (HARTVÁNYI et al., 2023).

In recent years, wearable sports and healthcare devices that monitor vital signs and health have been the focus of research. Monitoring of bioelectrical signals, biophysical signals, and biochemical signals, are critical for athletic training, including the diagnosis and prevention of medical conditions, and rehabilitation. Monitoring of signals in health management (e.g. disease prediction) is now possible thanks to advanced manufacturing, new electronics, Internet of Things (IOT), and artificial intelligence algorithms (Sun et al., 2022). What distinguishes technologies from inventions and creative ideas is that it facilitates economic growth. For example, technologies such as analog film cameras have evolved into advanced digital cameras, digital single lens reflex, mirrorless cameras and smartphone cameras. Sensor technologies, micro/opto/nano industries, battery technologies, memory cards and telecommunications have transformed the assembly and manufacturing of cameras and the experience for the photographer. The camera industry has supported advertising, entertainment, publicity, archiving, sciences, photography, hobbies and various professions for more than a century.

BMW's M Division has facilitated improved product designs with the collaboration of customers and BMW engineers. Ducati, a two wheeler manufacturer used a Virtual Customer Environment called Tech Cafe for product conceptualization. Eli Lilly, a healthcare services firm, uses an Internet portal to integrate its services with pharma customers who consist of patients, clinicians, healthcare providers,