

Chapter 58

Strategies of Sustainable Bioeconomy in the Industry 4.0 Framework for Inclusive and Social Prosperity

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ABSTRACT

The last two decades have witnessed unpredictable transformations in knowledge-related areas. The main reason for this change is the fourth industrial revolution, a knowledge revolution affecting fields like the bioeconomy. The third industrial revolution, which induced the use of fossil-based energy sources, created a major global problem. Likewise, the third industrial revolution introduced the problem of the excess usage of food, animals, water, and other resources. Industry 4.0 offers an efficient solution to excessive tendencies. This chapter aims to analyze changes and offer strategies in the bioeconomy framework within Industry 4.0.

INTRODUCTION

Food is a basic human need. Therefore, the agricultural sector has become the most important part of the economy. The share of agricultural production in the economy has been declining over the last two decades. However, investments have boosted productivity. This growth is negatively affected by the degradation of natural resources, global climate change, excess use of pesticides, and loss of biodiversity. Additionally, technological progress has impacted human needs, increased productivity, and changed production methods. Technological progress has changed the path of the agricultural sector by affecting the production methods.

The Food and Agriculture Organization of the United Nation reported that the human population is expected to increase to 10 billion by 2050 in the “The Future of Food and Agriculture – Alternative Pathways to 2050” report (FAO, 2018). Food security will be the main problem faced by governments.

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Most of the literature estimates more severe crises in both numbers and intensity, giving rise to poverty and hunger throughout the world. In this context, it becomes very important to analyze the importance and impact of technology on agricultural production, agricultural productivity, and the share of the agricultural sector in the economy.

This study analyzes the impact of technology on the agricultural sector. It highlights sustainable development and discusses a sustainable bioeconomy. This study offers technology-based policies for a sustainable bioeconomy with inclusive growth.

BACKGROUND: A HISTORY OF REVOLUTION, EMERGENCE OF INDUSTRY 4.0, AND THE AGRICULTURAL SECTOR

History reveals seven critical transitions of humankind. Three of these transitions focus on agriculture and the volume of food production. Four of the transitions are industrial, focusing on mechanization. First, the Neolithic revolution (or the first agricultural revolution) is a basic and critical revolution that changed humankind from hunter-gatherers to a farming society. About 14,000 years ago, humankind domesticated plants like wheat, barley, peas, and livestock. The Neolithic revolution increased life expectancy and improved human life by establishing cities with more food. These developments promoted new work, jobs, merchandising, and trade. Specializations introduced skilled professions. Society became more complex, requiring new rules. This need brought about an authoritative government.

After 15,000 years, humankind witnessed the second agricultural revolution, which coincided with the industrial revolution. Between the 17th century and the green revolution of the 1940s, farmers became more capable. They increased productivity with ideas like selective breeding, crop rotation, and fertilizers. The industrial revolution also brought farm machines and tools, increasing productivity and production in a short amount of time. Demographics changed as farmers replaced machines with workers. More food affected the rapid growth of cities as people stopped producing food for self-consumption. These changes in society and production promoted the industrial revolution.

The third revolution, termed the green revolution, affected the life of humankind. Genetically engineered crops and/or genetically modified organisms opened a new stage in agriculture and the economic sector. The yield of wheat increased fourfold in 25 years; many countries became self-sufficient. The green revolution satisfied an increasing demand of food due to the increasing population of a healthier society.

The three agricultural revolutions increased the quantity of food and promoted the industrial revolution, the key driver of modern society's way of life. In the middle of the 18th century, the economic system changed radically with the invention of James Watt's steam machine. The system moved from an agrarian economy to an industrial economy. New tools and/or machines enabled large-scale production using new materials. Factories grew as labor became more important. Transportation, communication, and steam-powered machines and vehicles were also key to the first industrial revolution. The growth of agricultural and industrial production was a new source of wealth. Increasing productivity promoted international trade and national prosperity.

The second industrial revolution was a technological shift during the 19th century. Electricity changed the world through many inventions between 1870 and 1910. Mass production, chemical synthesis, synthetic raw materials, oil as a substitute and primary energy source, long-distance communication, the first flight, Edison's lightbulb with tungsten-based filament, and Ford's Model T assembly line are examples that reflect the characteristics of the second industrial revolution.

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