Chapter 46
Evaluation of Influence of Principles Involved in Industry 4.0 Over Coal Industries Using TISM

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ABSTRACT

Coal is the major source of energy in the world. But, the process of extraction and use of coal has adverse effects on the environment. In this chapter, the authors try to reduce these effects by considering the principles and technologies involved in Industry 4.0, also known as the Fourth Industrial Revolution. From a few expert reviews and research works, eight crucial factors were taken into account and were analyzed. The eight factors are consumer, water resources, smart transportation, smart factory, smart grid, smart mining, smart home, and renewable energy. The analysis has been made using the total interpretive structural modeling (TISM) method. The model distinctly demonstrates the influence of the principles of Industry 4.0 over coal industries. This chapter also aims to pave the way for future research and tries to contribute towards the sustainable extraction and usage of coal in energy industries. Consumer plays the most influential role in this regard.

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INTRODUCTION

Coal, being the major energy source, is also the cause of most of the carbon gas release in the world. The extraction process of coal and its by-products leads to environmental damage, health problems, climate change, pollution of water bodies, depletion of ground water and acid rain thus affecting the day-to-day life of human beings as well as other living beings. Many alternatives have been found, yet, the effects are still too high to be ignored. Switching to natural gases, renewable resources and hydrogen fuel can match neither the energy requirements nor the production output of coal industries. Hence, researchers and experts suggest the principles of Industry 4.0 as a means to make the coal production process more sustainable and less environment affecting. The main objective of our paper is to evaluate the factors influencing coal industries by using Total Interpretive Structural Modeling (TISM) for lessen the impacts of environment with the help of Industry 4.0 principles.

The process of industrialization has gone through three phases, namely, The First, Second and Third Industrial Revolutions. Each revolution has its own unique characteristics that enabled them to protect the environment and avoid material wastage. For the first time in 2011, during the Hannover Fair event, a proposal for the development of German economic policy based on higher technological strategies was made, symbolizing the beginning of the Fourth Industrial Revolution (Lee 2013 & Masconi 2014). Global industrialization and the development of technologies such as automation, cloud computing and deep learning have led to Industry 4.0. Production processes have become more sustainable, effective and persistent due to the aforementioned technological developments (Wahlster 2012). Industry 4.0 also deals with Internet Of Things (IOT) and effective Information and Communication Technology (ICT) infrastructure. The effective communication network between the related sectors formed through these technologies provide better real-time communication capabilities, thus helping with the reduction of cost, wastage, CO_2 emission and lead time of coal production. Thus, the above- mentioned influential factors are proposed through intensive literature research and TISM method. The factors related to Industry 4.0 are studied by many researchers (Lee et al., 2014; Wollschlaeger et al., 2017; Wan et al., 2019; Zheng et al., 2018).

In the Section 2 literature review is presented, the problem description is discussed in section 3, the proposed methodology is discussed in section 4, in section 5 results and discussion is presented, the managerial implications and conclusions are presented in section 6 and 7 respectively.

LITERATURE REVIEW

Literature review is classified into eight sections namely (i) Smart Transportation (ii) Smart Factory (iii) Smart Mining (iv) Consumer satisfaction (v) Water Resource (vi) Smart Grid (vii) Smart home (viii) Renewable Energy . They are detailed as follows:

Smart Transportation

Managing an industry's transportation system using various information and communication technologies in an effective manner is called smart transportation (Stefannson & Lumsden 2008). In the case of electric vehicles, based on the service requirements, charging stations are set up and programmed