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Structural model for sustainable consumption and production adoption—A grey-DEMATEL based approach

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ABSTRACT

Sustainable Consumption and Production (SCP) patterns are becoming important in the implementation of sustainability in industrial contexts. In this sense, this study uniquely focuses on developing a structural model to evaluate the sustainable consumption and production adoption drivers and to improve sustainability aspects in the supply chain scenario under uncertain environments. Initially, fourteen drivers related to sustainable consumption and production adoption were selected from the literature and expert feedback. Then, the grey based Decision Making Trial and Evaluation Laboratory technique was used; this approach not only helps to identify the causal relationships between the selected drivers but also helps to evaluate the strength of their interrelationships. The findings indicate that ten drivers are considered influencing drivers and four drivers are called influenced drivers. "Governmental policies and regulations to develop sustainable consumption and production focused system" and "Management support, dedication and involvement in sustainable consumption and production implementation" have been found as the most influencing drivers and "Gaining the market edge and improving the overall performance" and "Initiatives and promotional schemes regulated by various agencies in sustainable consumption and production implementation" the most easily influenced drivers. This work features an Indian automotive case example to show the proposed model applicability. The finding of this work provide a structural support to the managers by knowing the cause (influencing) and effect group (influenced) drivers in sustainable consumption and production implementation in industrial supply chains. By knowing the cause and effect group drivers, managers can more easily analyze the relevant issues in sustainable consumption and production adoption on the shop floor and, consequently, will be better able to improve overall performance. Finally, the unique contributions and limitation of the work are highlighted to provide a foundation for future research.

1. Introduction

Exponential growth is expected in the world's population; in fact, it is estimated to reach nine to ten billion by the year 2050. As a result of this growth, several critical issues will emerge among societies, including bio-diversity and environmental degradation, climate change, and economic disruptions (Ingrao et al., 2016). Despite the desire for a sustainable future, this accelerated global development and associated ecological impacts cannot be achieved through traditional unsustainable production and consumption business activities (Bocken et al., 2014). Unsustainable patterns of consumption and productions are important causes in the depletion of natural resources and ecosystems throughout the world (Griggs et al., 2013). Further, the industrial sector, which has expanded widely to fulfill the range of human demands, has also contributed significantly to exploitation of the natural resources (Ingrao et al., 2016). Fortunately, the expectations of various stakeholders, such as consumers, employees, owner(s), government regulatory bodies, competitors, and investors, have become a driving force for industries to consider the environment and social aspects in the supply chain (SC) (Mangla et al., 2013; Luthra et al., 2015). Thus, Sustainable Consumption and Production (SCP) patterns are becoming important in the implementation of sustainability practices all across the world (Lehtoranta et al., 2011; Almeida et al., 2013). At the 1992 Rio Earth Summit and later reinforced during the agenda of the Rio + 20 conference, researchers discussed that production and consumption patterns form a major reason for the extensive deterioration of the global environment.

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The UN World Summit on Sustainable Development in 2002 suggested a 10-year framework for implementation of SCP initiatives. The implementation of SCP is an important requirement to tackle growing emissions problems and to achieve sustainable business development (Gaziulusoy et al., 2013; Whiteman et al., 2013; Blok et al., 2015).

Successful SCP adoption and implementation requires transformations in an organization's vision and it requires education to adopt sustainability aspects in SCs (Govindan, 2017). While researchers have demonstrated an increasing interest in studies on SCP behavior (particularly on antecedents and indicators for SCP behavior), the subject still lacks the development of suitable frameworks to thoroughly understand the adoption of SCP initiatives in an organization's supply chain. The transition towards SCP patterns is presently a key challenge for engineering science, environmental science, and especially in governmental policies. A systematic study is needed to address the economic, ecological, and social changes in business for sustainable development (Bocken et al., 2014). However, researching the transition to a SCP system and its implementation is very difficult (Kronenberg and Bergier, 2012). This challenge is due to differences in consumption and production-related systems and the drivers involved (Brizga et al., 2014). Hence, a comprehensive understanding of the drivers of production and consumption, including the sustainable context in which SCP activities take place, is required in industrial supply chains (Akenji and Bengtsson, 2014).

This research has two objectives:

i to identify the drivers related to successful SCP adoption in the supply chain;
ii to evaluate the identified drivers in order to understand their interrelationships in the successful adoption of SCP in the supply chain.

In terms of conceptual development, the present work seeks to evaluate the drivers to SCP adoption in a supply chain context. This is a multi-criteria decision analysis problem. To help the industrial sector, this work seeks to identify and evaluate the causal relationships between the drivers related to the successful SCP adoption in the supply chain. To identify the drivers, experts' opinions and related literature resources are used, and to evaluate the identified drivers, we propose to use a grey-DEMATEL based technique. Decision making trial and evaluation laboratory (DEMATEL) methodology can help structure the complex causal relations through digraphs which depict relationships between drivers (Govindan et al., 2015). DEMATEL can reveal the relationships among drivers; however, it is difficult to describe the uncertain relationships and potential vagueness in the data. Grey set theory is an approach that can deal with the uncertainty. In this sense, grey-DEMATEL is used in this work to determine interrelationships among the identified drivers in the successful implementation of SCP trends in the supply chain (Bai and Sarkis, 2013). It is noted that such evaluations may possibly vary with organization type, and hence, we attempt to keep the proposed grey-DEMATEL based approach as generic as possible to emphasize its usefulness in real-life cases. Further, in the later part of this paper, the case example of an Indian automotive company is discussed to demonstrate the applicability of the suggested model. From the perspective of an emerging country like India, there is a lack of initiatives incorporating SCP decisions in business. Notably, the Indian case organization featured here seeks to identify and evaluate the drivers related to successful SCP adoption in their supply chain.

The rest of this manuscript is structured as follows. Related literature is provided in Section 2. Solution methodology used in the present work is elucidated in Section 3. An example and related results are presented in Section 4. The managerial implications are provided in Section 5. Finally, conclusions are drawn along with the unique contribution, limitations, and future scope of research in Section 6.

2. Literature review

This section covers the relevant literature on SCP and its importance in supply chains, drivers important to the SCP implementation, and it outlines the research gaps for the present study.

2.1. SCP and its importance in supply chains

The transformation towards SCP plays a major role in the formulation of business sustainability (Akenji and Bengtsson, 2014). Researchers at the Oslo Symposium in 1994 defined the SCP as "the use of services and related products, which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardize the needs of further generations" (Coelho and Lange, 2016). SCP can also be understood as the production and use of products and services in a manner that is socio, economic, and ecological friendly over their whole life cycle (Pesonen and Horn, 2013).

SCP is becoming an essential policy matter to deal with energy scarcity, green issues, and carbon management issues (Zhu and Geng, 2013). SCP can help in reducing ecological pollution, promoting resource efficiency, promoting sustainability-focused aspects to better production and consumption practices (Nash, 2009; Berg, 2011). SCP can also be understood as a life cycle based approach of products/services to distinguish the overall impacts along the value chain (Lorek and Spangenberg, 2014). SCP provides a means to transform economies and societies to develop a sustainable culture for the benefit of humankind. The adoption of SCP culture may also positively affect the nature of consumption and production aspects in various systems (Blok et al., 2015).

Many organizations are actively contemplating sustainable business practices in their SCs; in fact, SCP issues are becoming a significant practice for organizations to ensure sustainability (Gunasekaran and Spalanzani, 2012). The relationship among suppliers, organizations, and customers is important to search for the most effective SCP models and to highlight changes in the current framework that must be undertaken at all supply chain levels to reach a desired outcome (Almeida et al., 2013). However, most organizations currently do not have skill sets needed for the successful adoption and implications of SCP practices; one reason for that difficulty is simply that the SCP research field is not yet well structured (Vergragt et al., 2015), defined, or implemented. The above-mentioned statements logically support the need to address SCP concepts in the SC.

SCP terminology is practically nonexistent in regulations, although numerous countries' strategy of sectoral policies do provide a few elements supporting SCP trends (Brizga et al., 2014). Horn-Phathanothai (2014) recommended the adoption of SCP practices to achieve equity and to create opportunities for developing countries to grow in sustainable ways. Due to the turbulent business environments in many emerging counties, a focus on their economies is especially important because of the higher degrees of uncertainty and complexity associated with supply chain sustainability (Silvestre, 2015a, 2015b).

2.2. Drivers to the SCP adoption in SC

Ecological deterioration, climate issues, and increasing resource scarcity are all the results of unsustainable production and consumption patterns and systems (Vergragt et al., 2015). The