



Review

Occupational health and safety issues in operations management: A systematic and citation network analysis review

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ABSTRACT

This study reviewed 128 articles that examined occupational health and safety (OHS) issues in operations management (OM). We first investigated the distribution of articles by journal type, year of publication, methodologies and research contexts. Based on citation network analysis, an objective approach to identify clusters of articles in the OHS literature, we found four major research domains of OHS issues, which are safety climate, management systems integration, voluntary OHS systems and sustainable operations. We further drew a map of knowledge structure by conducting a Main Path Analysis of articles within each research domain. Finally, we concluded the future research opportunities for each research domain of OHS from an OM perspective.

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1. Introduction

Governments of developed countries pay much attention to Occupational Health and Safety (OHS) issues. In the United States

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(U.S.), about US\$583 million are allocated annually for Occupational Safety and Health Administration (OSHA, the official OHS authority) to regulate the industries (Department of Labor, 2012). However, workplace accidents and illnesses are still occurring frequently. In the U.S., nearly four million workers suffer injuries at workplace every year (Solis, 2012). Average 13 workers were killed at their workplaces every day in 2012 (Bureau of Labor Statistics, 2012). U.S. firms lose about US\$170 billion due to workplace injuries and illnesses every year (Occupational Health and Safety Administration, 2003), which is a significant increase from US\$112 billion in the 1990s (Brown, 1996). Since workplace accidents and illnesses can critically interrupt firms' operations, OHS management is always a major concern for operations managers (Brown, 1996; Smallman and John, 2001).

OHS management is usually considered a vital component of business sustainability, besides environmental management (Kleindorfer et al., 2005; Montero et al., 2009). Though operations research about sustainability has continued to grow, OHS management has often received much less attention compared to environmental management (Das et al., 2008; De Koster et al., 2011; Seuring and Muller, 2008). In recent years, OM scholars have been paying more attention to OHS issues. It is essential to examine the existing OHS studies to put forward suggested thrust of the future research trends in OHS issues in the OM literature.

However, to the best of our knowledge, no comprehensive and systematic review of OHS issues has been published in the OM discipline. We have been able to find only seven works that have reviewed fractions of the OHS literature. Guldenmund (2000) reviewed 17 safety culture and climate studies published in the 1980s, primarily based on social and organizational psychology perspective. Choudhry et al. (2007) reviewed the safety culture issues in the construction industry. Kleindorfer et al. (2005) reviewed literature on sustainable operations management but OHS issues were not their focus. Cohen and Kunreuther (2007) reviewed all articles published by Paul Kleindorfer about operations risk management; OHS was one of the sub-topics. Gunasekaran and Spalanzani (2012) reviewed sustainable business development (SBD) literature but OHS issue is only one of the several points of focus. Robson et al. (2007) attempted to review the effectiveness of Occupational Health and Safety Management System (OHSMS) based on 13 articles from safety, medicine and public policy journals. To comprehend the shortcomings of previous review works, this research attempts to provide a comprehensive and systematic literature review on OHS and position the discussion with OM perspective. Thus, specifically, the objectives of this review are as follow:

1. To describe the nature of OHS related articles in terms of distribution by journals, year of publication, methodologies and research contexts.
2. To identify the major research domain of OHS based on the articles' citation network.
3. To draw the map of knowledge structure of each major research domain of OHS literature.
4. To conclude the research trend and suggest future research opportunities for each research domain of OHS from an operations management perspective.

2. Methodology

We collected the sample articles from 7 peer-reviewed journals, namely, International Journal of Production Economics (IJPE), International Journal of Production Research (IJPR), Journal of Cleaner Production (JCP), Journal of Operations Management

(JOM), Manufacturing and Service Operations Management (MSOM), Production and Operations Management (POM) and Safety Science (SS). Apart from the last, SS, all other journals are considered top tier journals in the OM discipline. We included SS because it is the most prestigious journal in the safety literature (in terms of impact factor and publication history) and it is interdisciplinary in nature. We conducted full text search of journal articles in the Scopus database by keywords of "safety management", "accident", "occupational", "workplace" and "operation". The review period is from 1996 to 2012. Our search focused upon operations management literature; some areas of safety literature such as safety technology, ergonomics and environmental hygiene are not included. At last, 128 articles were collected as the samples.

The primary limitation of previous systematic literature reviews (SLR) is the identification of the research domain and knowledge structure. Both tasks are commonly determined from the author's judgment, which is considered subjective (Colicchia and Strozzi, 2012; Ngai et al., 2007). In recent years, scholars have tried to introduce citation network analysis (CNA) into systematic literature review (SLR) to pursue an objective approach for research domain classifications (e.g., Chen and Redner, 2010; Colicchia and Strozzi, 2012).

The purpose of CNA is to identify the research domains, to reveal the evolution of research tradition and to map the changing paradigms (Hummon and Doreian, 1989; Colicchia and Strozzi, 2012). The basic assumption of CNA is that the citation networks constitute not only formless connections between articles but also systematic channels that transform scientific knowledge (Hummon and Doreian, 1989). Researchers in the same field tend to cite each other and add new knowledge in the latest researches and thus it pushes the advancement of knowledge about a particular research field (Colicchia and Strozzi, 2012). The CNA approach can offer a more objective analysis than the authors' judgment of traditional SLR (Colicchia and Strozzi, 2012; Ngai et al., 2007).

The citation and reference data of sample articles were recorded for the current review. Based on the common approach of network analysis (Wasserman and Faust, 1994), a binary matrix was constructed to record the citation networks in the sample. The be-cited references were recorded in rows while the samples were recorded in columns. The value "1" is given if a citation relationship exists between column samples and row references, otherwise value "0" is given.

3. Descriptive statistics

This section presents the articles' distribution by journal, year of publication and article type. The sub-sample of empirical studies was further studied by examining the research methodologies used and their research contexts (i.e., industry and country). The descriptive statistics provide an overview of the current status of OM research in OHS issues.

3.1. Distribution of articles by journal

Fig. 1 shows the distribution of articles in the seven journals. The six OM journals account for 33 articles (25.78%), where 17 articles are from JCP (13.28%), 6 are from POM (4.69%), 5 are from JOM (3.91%), 3 are from IJPE (2.34%), 1 is from IJPR (0.79%) and 1 is from MSOM (0.79%). Meanwhile, 95 articles are from SS (74.22%). The distribution shows that OHS issues have received little attention from the traditional OM journals, despite Brown's (1996) call for more OHS related works in the OM discipline more than 15

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