Journal of Cleaner Production 147 (2017) 242–253

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Forecasting number of ISO 14001 certifications in the Americas using ARIMA models

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ARTICLE INFO

Article history:
Received 26 April 2016
Received in revised form
15 January 2017
Accepted 16 January 2017

Keywords:
ISO 14001
Environmental management
Americas
Box-Jenkins methodology
ARIMA models
Forecast

ABSTRACT

The ISO 14001 standard has been showing increasing importance for environmental management in organizations worldwide. Predicting the behaviour of the number of certifications in the coming years is an important strategy for planning and organizational management. Accordingly, this work aimed to adjust forecast models for the number of certifications in the Americas and their countries over the next two years, 2016 and 2017. The study was conducted with data of ISO 14001 certifications on the continent and its 13 countries with the highest number of certifications between 1996 and 2015. The Box & Jenkins methodology was applied in the adjustment of the forecast models for the annual data series. The ARIMA models adjusted to the ISO 14001 series showed a downward trend in the number of certifications in the Americas predicting, respectively, 17,467 and 16,805 certificates issued in the years 2016 and 2017. A downward could also happen in Canada and Colombia. Brazil, Mexico and the United States have a growth trend in the number of new certifications. These results suggest a reduction in the number of certifications, but also suggest that the leading countries in number of ISO 14001 certifications should remain interested in implementing the standard in coming years.

1. Introduction

The growing concern over the environmental impacts of human activities has attracted the attention of governments and society in general, becoming a priority for organizations as well. Pressure from investors, the consumer market and increased environmental regulation on the business sector have encouraged managers to develop strategies and social-economic measures to adopt more sustainable practices. In the last decades, companies began to focus on the main causes of environmental impacts arising from their production processes, through the adoption of a preventive and proactive approach (Oliveira et al., 2016).

One of the actions developed to demonstrate appropriate environmental performance is the adoption of management tools. Among these tools is the ISO 14001 standard, a certification known internationally for the implementation of Environmental Management Systems (EMS). Launched in 1996 and revised in 2015, ISO 14001 specifies the requirements for any company or organization to be able to set up an effective Environmental Management System to develop and implement, according to ISO (2004), "policies and objectives which take into account the legal and other requirements to which the organization subscribes and information about significant environmental aspects".

According to Potoski and Prakash (2005) and Arimura et al. (2016), organizations should adopt an extensive and costly EMS that requires certification by an independent third-party auditor, which helps to ensure that it conforms to the ISO 14001 standard. Companies should review their practices and environmental systems, measuring the environmental performance, implement an action plan to change it, identify internal responsibilities and verify and correct any problems (Bansal and Hunter, 2003; Potoski and Prakash, 2005).

Although there is limited evidence that ISO 14001 certification leads to reduced resource consumption and pollution (Nguyen and Hens, 2015), the adoption of ISO 14001 has become interesting to many companies in the world. McGuire (2014) states that compared to traditional government regulations, voluntary approaches such as ISO 14001 have been an effective alternative to overcome weaknesses of traditional regulation and provide incentives for companies to promote sustainable actions while reducing high costs associated with regulation required by law. Arimura et al. (2016, p. 556) also emphasize that voluntary

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http://dx.doi.org/10.1016/j.jclepro.2017.01.084
0959-6526/

corporate initiatives often lead facilities to perceive their emissions levels, and then "to emphasize reductions in unregulated environmental impacts that could lead to greater overall pollution reductions".

Thus, companies have increasingly adopted the standard in order to systematize and formalize procedures related to the environmental impacts of the organization, through a continuous improvement process, aiming at ongoing changes in the management of measuring tools and management controls (Bansal and Bogner, 2002; Bansal and Hunter, 2003; Casadesus et al., 2008; Marimon et al., 2009). According to ISO (2016a; 2016b), since 1999, more than 2.7 million certificates have been issued worldwide and this number has grown over the years, with a total of 319,324 certificates issued to 201 countries in 2015.

The ISO 14001 standard has been spreading around the world and recently gaining importance among governments, certifying institutions and organizations and encouraging the development of works with the aim of understanding the factors that have motivated companies to adopt ISO 14001 (Nishitani, 2009; Heras-Saizarbitoria et al., 2011; Lozano, 2012; Arimura et al., 2016). In the American continent, several researchers have focused on investigating what has led organizations in countries of that region to certify or not their structures (Bansal and Bogner, 2002; Blackman, 2008; Freitas and Iizuka, 2008; Blackman and Guerrero, 2012; Earnhart et al., 2014), but little is known about the future prospects of this certification on the continent. In this way, the importance of conducting new studies related to this topic is noticeable.

In addition to exploring the reasons that have led companies to adopt the ISO 14001 certification, it is interesting to study the behaviour of the evolution in the number of certificates over time. This is important for companies to direct their investments in alternatives to promote sustainability and it is relevant to help policy makers and institutions involved in ISO standards to determine where they should focus their resources in launching management standards, in the future. In recent years, a significant number of studies have been conducted in order to understand the distribution and project the growth in the number of certifications globally (To and Lee, 2014). However, there is still a lack of studies based on the American continent, particularly in Latin American countries, despite the growing importance of ISO 14001 in the region (Hikichi et al., 2016).

Thus, this study aimed to propose the application of Box & Jenkins methodology (1970) to make the adjustment of forecasting models in order to ascertain the prospects for the behaviour of the number of new certifications in the American continent in the coming years. The methodology used to obtain the models can also be easily applied to studies in other regions involving other certifications, and represents an alternative to diffusion models already studied in the literature (Viadiu et al., 2006; Casadesus et al., 2008).

This work contributes to the existing literature in three ways. First, it presents new insights on the diffusion of ISO 14001, which is important to business managers and governments in the American countries. Second, it makes it possible to identify areas with more companies engaged in this voluntary approach, an important factor in understanding the motivations that have led companies to adopt the environmental certification. Finally, it presents a new application of Box & Jenkins models to forecast the number of certifications in situations where diffusion models cannot be applied, e.g. if they fail the assumptions for Analysis of Variance.

2. The diffusion of ISO 14001

2.1. The ISO 14001 standard

ISO 14001 is the most popular standard of the ISO 14000 series and specifies the requirements for any organization to implement an EMS, a "framework to protect the environment and respond to changing environmental conditions in balance with socio-economic needs" (ISO, 2016a). Launched in September 1996, its structure was constructed based on the ISO 9001 Quality Management Systems standard, and the latest revision of ISO 14001 was held in 2015. The newly revised version responds to the latest world trends and includes a series of improvements, as a stronger focus on the integration between environmental issues and organization's strategy and relevance on Life-cycle perspective (ISO, 2015).

An EMS constitutes a set of procedures that establishes an environmental policy so that the organization can manage its environmental aspects and reduce the impacts on the environment (Barla, 2007; Perkins and Neumayer, 2010). It is based on a continuous improvement model, founded on the concept of Plan-Do-Check-Act (PDCA), principles widely used by organizations to achieve continuous improvement.

The importance of the ISO 14001 certification in the current scenario is justified by the fact that many organizations are increasingly concerned with achieving and demonstrating correct environmental performance by controlling the impact of their production processes and services on the environment (Rino and Nemesio, 2016). The popularity is also due to its recognition by influential companies in some industrial sectors and its role as a differential factor regarding stakeholders (González-Benito and González-Benito, 2005).

Generally, the motivations that have been driving companies to adopt ISO 14001 can be classified, according to their origin, in external or internal factors (Heras-Saizarbitoria et al., 2011). Among the external benefits most frequently mentioned in the literature are: demonstrating commitment to environmental management to stakeholders (Nishitani, 2009), meeting the pressures of the global supply chain (Nishitani, 2010), facilitating trade and reducing trade barriers (Psomas et al., 2011), and also as a competitive advantage (Bansal and Bogner, 2002; Panwar et al., 2016), improving corporate image and relations with authorities (Corbett and Kirsch, 2001), as a marketing tool (Oliveira et al. (2016), and by pressures from government agencies and non-governmental organizations (NGOs) linked to the environment (Bansal and Hunter, 2003).

In turn, the internal motivations for a company to adopt ISO 14001 are generally related to the implementation of EMS to improve environmental performance and the effects of this environmental management change on the internal strategy and capacity of the organization (Heras-Saizarbitoria et al., 2011; Prajogo et al., 2012). Among the factors mentioned in the literature are compliance with environmental targets and cost reduction (Nishitani, 2009), assistance in operations and production, assessment and communication (Lozano, 2012), reduction of environmental impact with improved management control (Bansal and Hunter, 2003), flexibility in the types of environmental goals that companies wish to establish (Arimura et al., 2016) and improvement in efficiency and effectiveness in internal operations of the company (Bansal and Bogner, 2002).

Despite the assumptions, ISO 14001 does not bring noticeable benefits for environmental management in all situations and possible institutional and economic gains may be imperceptible. However, an effective EMS can provide advantages that go beyond environmental gains, providing conditions for the organization to achieve overall continuous improvement of its management system (Hikichi et al., 2016).

2.2. Models applied to ISO 14001

Understanding the evolution process over the years in the