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Environmental Performance Measurement Review of Indicators and Obstacles

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Abstract

Environmental performance measures (EPMs) are components of environmental management accounting, quantitatively representing the efficiency and effectiveness of an organisation's environmental performance. Organisations seek to measure their environmental performance either because of the potential benefits associated with it, or in response to environmentally oriented stakeholders, or from the ethical motives of their higher management. The aim of this paper is to conduct a comprehensive literature review concerning EPMs in terms of its concept, importance, uses, characteristics, types and the maximum difficulties associated with their application.

Keywords: Environmental, Measures, Sustainability, Performance

Introduction

With the greater attention to global warming and sustainable development, the environmental performance (EP) of policy analysts and decision-makers has emerged, which has led to a number of laws, regulations and penalties related to environmental threats (Jinet al., 2014; Lo-iacono-ferreira et al., 2017). These actions have forced organisations to take responsibility for their environmental actions (Braam et al., 2016), especially since environmental issues have a direct or indirect impact on organisations (Ntoskas, 2006; Henri & Journeault, 2008). Thus, organisations should face the effects of their processes on the environment (Sun et al., 2017); however, to mitigate them by measuring EP, which is an important issue for many organisations, it is necessary for some organisations to obtain a license of operation (Hourneaux et al., 2014; Lisi, 2015).

This research paper focuses on the importance and the characteristics of the environmental performance measurement (EPM) and highlights the difficulties associated with its application.

The paper has been divided into four main sections. Section 2 discusses the materials and methods adopted in this review study. Section 3 illustrates the results concerning the definition, types, measures and main obstacles of EP. Section 4 summarises the conclusions and perspectives of the study.

Materials and Methods

Here, a comprehensive review on EPMs uses, characteristics, types and associated obstacles have been undertaken. The main objective is to define the basic terms that convey knowledge through published studies. Science Direct was selected as a database for research because it provides trusted and diversified research papers. It also contains developed search tools and comprehensive references related to the topic.

Searches were conducted between January 2018 and January 2019. The research was guided by a set of terms that were found through literary review, combining the following elements: environment, sustainability, measures, framework and performance. The combination of these produced 71 articles that were found to be suitable for in-depth analysis. After removing duplicates, 46 papers were selected.

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Table 1: Results of the Combination of Terms

Sr. No.	Combination of Terms	Science Direct
1	Corporate performance	495
2	Environment* sustain*	235
3	Environment* measures	318
4	Measures+Environment*+sustain*	240
5	Corporate+operations+performance	228
6	Corporate+environment*+measures	203
7	Corporate+environment*+framework	275
8	Corporate+sustain*+environment*+framework	67
9	Corporate+performance+measures+environment*+sustain*	26

Results

Sustainability and EP

Sustainability has become an increasingly important issue among organisations around the world and has been an international concern over the last decade (Blass & Gouvea, 2015; Gallego-álvarez & Eduardo, 2017). This increased interest in sustainability has led the organisation to incorporate it into their strategies and activities (Dragomir, 2018).

Although sustainability theories are sometimes viewed as fashionable, sustainability accounting can be used as an important tool to identify resource constraints as well as its ability to integrate and achieve financial, environmental and social responsibilities (Qian et al., 2018). General Reporting Initiative (GRI) (2016) defined sustainability as development which deals with the needs of the present without affecting future generations' needs.

Sustainability represents a multifaceted concept depending on three fundamental pillars: environmental sustainability, social sustainability and economic sustainability (Amrina & Yusof, 2011; Picazo-tadeo et al., 2014; Acquaye et al., 2017; Sun et al., 2017).

Although most studies have focused on EP alone, while social and economic performance have received less attention, the three dimensions must be equally noticed for effective sustainability assessment (Amrina & Yusof, 2011; Qian et al., 2018).

Many organisations are looking for ways to understand, communicate and improve EP by effectively managing the elements of activities, products and services provided by the organisation that can significantly affect the environment (Lo-iacono-ferreira et al., 2017).

EP represents the company's effectiveness in meeting and exceeding society's expectations regarding the natural environment. In this context, we notice that EP definition does not only include environmental impacts, but also the social perspective, which take into account the harmonious relationship between society and external stakeholders (Henri & Journeault, 2010; Lisi, 2015). Moreover, EP is the process of strengthening the environmental management system (EMS) to achieve improvements in the overall EP (Comoglio & Botta, 2012. P:92).

Concerning the managerial aspects, EP conveys measurable results about the management of environmental strategy. This is translated by first measuring environmental impact and consumption of resources, and second by ensuring the related technological capabilities such as staff training, supply chain management and stakeholder communication (Dragomir, 2018. P:16).

EPM Concept

Managers need to manage their organisations with information about their organisation's performance. To obtain this information, several methods exist depending on the relative efficiency and the type of organisation. This is can be achieved depending on goal-related measures. These measures represent a component of economic and financial decision-making used to assess important factors related to a specific goal (Ferrando & Belda, 2017; Lo-iacono-ferreira et al., 2017).

When the key performance measures (PMs) are defined, the SMART criteria must be followed to ensure that they are specific, measurable, achievable, related and timely measure. According to studies (Blass & Gouvea, 2015; Blass et al., 2017), PMs should have certain characteristics

such as the measurability, the relevance, the clarity, the reliability, the accessibility to data and the long-term view.

Thus, the objective of the key PMs is to track the performance of the specific objectives.Through a true understanding of the EP, we can define the measures. In this context, several definitions of EPM have been introduced by environmental organisations such as the European Green Table, ISO 14031, European Environmental Agency, the Organization for Economic Co-operation and Development, and the Department for Environment, Food and Rural Affairs-UK.

EPMs are special expressions representing the link between the managers and the environment. EPM results are often numerically expressed, providing key information about environmental impact, regulatory compliance, stakeholder relations and organisational systems (Characklis & Richards, 1999; Henri & Journeault, 2008; Henri et al., 2016; Acquaye et al., 2017).

EPM Rationales and Utilities

The interactive use of EPMs guides the development of environmental management and operational initiatives (Henri et al., 2016). That means EPMs help in breaking down functional and hierarchical barriers that limit the flow of information and promote the discussion between the coordinators at different organisational levels.This, in turn, stimulates the development of new environmental ideas and initiatives, and thus the emergence of environmental opportunities. Accordingly, we find that organisations may adopt an environmental strategy either because of their associated financial advantages (Henri & Journeault, 2008; Lisi, 2015; Henri et al., 2016; Baboukardos, 2017), or show the legitimacy of their operations (Jasch, 2000; Jung et al., 2001; Henri & Journeault, 2008; Hourneaux et al., 2014; Lisi, 2015; Fuzi et al., 2016).

Several studies have divided EPMs into two types, financial and non-financial (Hoque & James, 2000; Henri, 2006; Henri & Journeault, 2008; Chan et al., 2014; Dragomir, 2018). The ability of financial measures to support decision results is demonstrated (Henri, 2006; Henri & Journeault, 2008). The benefit of measuring the EP lies in their ability to evaluate these organisations financially (Baboukardous, 2017).

However, despite the advantages of financial measures, they are seen as too historical and retroactive, lacking the predictive capacity to interpret performance, reward short- or incorrect behaviour (Henri, 2006; Henri & Journeault, 2008).

The use of EPM seems to have a positive impact on economic performance (Lisi, 2015; Naidoo & Gasparatos, 2018). Both types of financial and non-financial PMs should be used to describe the multiple aspects of organisational effectiveness (Hoque & James, 2000; Henri, 2006; Henri & Journeault, 2008; Dragomir, 2018).

In contrast, despite the criticism of financial measures, the importance of financial EPM is reiterated by practitioners and decision-makers. It appeared that organisations which have environmental allocations have a higher positive value compared to those whose balance sheets do not contain environmental allocations, and this emphasises the link between EP and financial performance (Baboukardos, 2017). Moreover, organisations that have performed well on environmental issues can increase their competitiveness (Poulsen et al., Hermann & Smink, 2018) and reduce litigation risk, thereby increasing future cash flows and market value (Aminian, 2012).

In contrast, most environmental costs are still not visible because they are allocated as public costs under traditional accounting systems. Thus, environmental management accounting (EMA) shows its utility in tracking and integrating both financial and non-financial environmental information (Jamil et al., 2015).

EPM Features and Uses

Although the attention paid to the PMs in management accounting, lesser attention was devoted to the various types of uses of EPMs within the EMA (Jasch, 2000; Henri & Journeault, 2008; Hourneaux et al., 2014). Although there are many pieces of literature examining the general use of various EPMs, the specific way to use these measures by managers as control mechanisms, as incentives or as a means of communication has been overlooked (Jasch, 2000; Henri & Journeault, 2008; Hourneaux et al., 2014).

EPMs have been recognised as an element of environmental management within organisations (Henri, Journeault & Rong, 2016). They play an important and influential role in measuring interactions between business and the environment (Henri & Journeault, 2008; Hourneaux et al., 2014). Managers need regular information to make

the right decision regarding the EP of organisations and to manage the environmental strategy (Henri et al., 2016; Dragomir, 2018). EPMs are shown as the appropriate tool for measuring the effectiveness of the regulatory efforts of the EMS (Dragomir, 2018).

Because of the nature of these measures, EPMs help to reduce the vast amount of environmental data related to the organisation in a comprehensive and concise manner, enabling decision-makers and other stakeholders to assess the EP of the organisation (Jasch, 2000; Hourneaux et al., 2014). EPMs provide decision-makers with an overview of the organisation's progress, as well as highlighting existing problems. On this basis, environmental policies can be supported in specific numbers, making the identification and monitoring of environmental objectives manageable and verifiable (Jasch, 2000).

Moreover, the use of EPMs enables the integration of environmental issues into regulatory actions and processes, which enhances EP by clarifying expectations and providing a strong reflection of environmental priorities. Environmental accounting is very useful for managers to support decision-making in terms of cost reduction, operation efficiency and product improvement. By identifying cause-and-effect relationships between ecological processes, strategies and targets, it appears that performance measurement systems improve decision-making (Jasch, 2000; Henri, 2006; Henri & Journeault, 2008; Hourneaux et al., 2014; Issa et al., 2015).

EPM Indicators

There are several attempts to classify the EPMs. EPMs can be classified based on either economic or environmental criteria. (Hoque & James, 2000) proposed six unrelated categories to classify EPMs: production, audit, ecology, accounting, economics and quality. From an environmental point of view, EPMs can be classified based on energy efficiency, waste reduction, educational training for environmental awareness, communication for environmental awareness, managerial knowledge on the environmental protection (Aminian, 2012). EPMs can also contain specific environmental indicators such as air, water, waste, public transport, urban environment management and energy (Jesinghaus, 2012).

These indicators need organisational and administrative preparations to assess the information. The organisational EP has two main pillars: EMP and environmental, operational performance, as the first type is quantitative and the second is qualitative (Jasch, 2000; Dragomir, 2018).

We notice a large number of assessment methodologies which imposes some difficulties on organisations in selecting and implementing EPMs (Issa et al., 2015). This has resulted in significant differences in the type and amount of data reported in environmental reports,which makes it difficult to compare EP (Jung et al., 2001; Mazzi et al., 2012).

Several indicators have been used for EP assessment, such as Luenberger measure, directional distance functions and data envelope analysis (Beltrán-esteve & Picazo-tadeo, 2017). Sustainable Balanced Scorecard has been combined the proposed measures within the GRI (Nikolaou & Tsalis, 2013). “G score” has also been proposed to measure the EP in the oil industry, consisting of five categories: general environmental management, input, process and output (Jung et al., 2001). This emphasized the utility of “G Score” in measuring the EP of organisations based on Enivroment-Health-Safety reports.

EP was also measured using Data Envelopment Analysis (DEA) and environmental DEA technology, based on carbon emission performance (Zhou et al., 2008). A model of DEA taking into account simultaneous and random data has also been suggested (Jin et al., 2014). DEA model, directional distance functions and Luenberger productivity measures have been suggested for the EP assessment of greenhouse gas emissions in the European Union (EU) for 28 countries during the period 1990–2011. Environmental efficiency enhancement is highlighted in order to improve EP in European countries (Picazo-tadeo et al., 2014).

EP measuring was also proposed in hospitals. This consists of three phases: concept, implementation and analysis (Blass et al., 2017).

Multi-Regional Input-Output method has also been used to calculate direct and indirect environmental impacts, and net flows of emissions and material consumption intensity for 33 countries over a 15-year time series (1995-2009). This is achieved using the average direct carbon emissions in the EU's 27 electricity sector at 1,368 million tons and indirect carbon emissions of 470.7 million tons per year

(25.6%) of the total EU carbon emissions (Acquaye et al., 2017).

EP at the provincial level is also assessed between 2006 and 2011 using the Driver force Pressure State Impact Response (DPSIR) model including (39) measures that were classified according to their importance and complexity within a three-level system: platinum level, golden level and green level (Pilouk & Koottatep, 2017).

We conclude that there are many ways to identify and classify EPMs, and we notice the existing debate about their effectiveness. It is therefore important that EPMs combine the simplicity required for effectiveness with the scientific perspective necessary for the reliability of operations (Chen et al., 2016).

EPM Obstacles

With the increasing concern about climate change, greenhouse gas emissions and poverty in biodiversity, and the result of stringent legislation and the increased pressure from stakeholders, the adoption of an environmental strategy has become important for many organisations worldwide (Lisi, 2015; Henri et al., 2016). This, in turn, pushes these organisations to adopt environmental strategies related to ethics, compliance, legitimacy or competitive motivation, which raise the awareness of managers about the economic benefits of EP (Hourneaux et al., 2014; Henri et al., 2016; Tang et al., 2016; Albuquerque et al., 2019). Thus, we can notice the mutual influence between the managerial strategy and EP (Dragomir, 2018. P:19). As a result, EP has become increasingly important for policymakers and decision-makers (Jin et al., 2014). EP has captured the attention of governments, private and public sectors since the 1980s since the customers are demanding organisations to be more responsible towards environmental issues (Aminian, 2012; Jamil et al., 2015).

However, Jamil and his colleagues (2015) indicated that most managers do not realise the benefits of improving EP and reducing environmental impacts, which in turn has resulted in the loss of many opportunities to reduce environmental costs.

EPM is an important element in strategies for achieving environmentally sustainable development (Lundberg et al., 2009). Furneaux and his colleagues (2014) indicated that EPM is a subject that has been addressed in different fields of science and has a rich diversity of methods, units of measurement and other elements, as well as a requirement for some organisations to obtain a work permit.

It has been shown that environmentally proactive firms result in reduced waste and discharge, increased efficiency, lower energy and resource costs, reduced risk and better reputation (Lisi, 2015).

The reasons of existing environmentally proactive firms can be driven by three main reasons: either because of the potential environmental benefits or because organisations respond to environmental stakeholders, from the moral motives of the senior management of these organisations (Lisi, 2015).

EP includes its ability to improve the environment (Moll & Uiterkamp, 2003), enhance the image of the organisation, reinforce environmental practices and encourage the use of environmentally friendly methods for waste reduction (Fuzi et al., 2016).

It has been recognised by many international organisations that environmental efficiency assessment is a powerful tool capable of providing managers and policymakers with useful information to design better management strategies and environmental policies (Azad & Ancev, 2014; Picazo-tadeo et al., 2014).

Henry and Journeault (2008) have shown that EPM is not limited to financial measures. Although these measures can present decision results in a comparable unit of measurement, they lack the predictive ability to assess future performance. They are also unable to give timely signals in addition to their inability to assess intangible assets.

The importance of EPM lies in the facilitation of environmental management, enhancing the goal, matching individual and organisational values and facilitating learning (Henri & Journeault, 2010; Lisi, 2015).

Therefore, reliable EPMs are necessary to obtain information for decision-making while ensuring environmental objectives are achieved (Henri & Journeault, 2008; Dragomir, 2018). Through EMs, organisations can support its environmental objectives in concrete numbers, making the identification and pursuit of environmental objectives manageable, where the

strength of EMs lies in the numerical analysis of trends and the possibility of comparisons from one year to the next (Jasch, 2000. P:80; Dragomir, 2018. P:16).

However, allocation support is needed for measures to face the problem of cost rising related to environmental problem-solving. Rising costs was recognised as one of the problems impeding the possibility of a detailed measure of EP (Kimura et al., 2012). Similarly, EPM has some of the costs that weaken its benefits, such as: enhancing the overload of information and dispersing administrative efforts on too many goals, reducing the stimulus by including multiple short-term and inconsistent goals (Henri & Journeault, 2010).

Some other difficulties were also noted, such as the difficulty of identifying and distributing PMs at each hierarchical level, as well as the prevalence of personal judgments in selecting appropriate measures. The criteria for an organisation may be redundant for other organisations (Blass & Gouvea, 2015).

Conclusion

The literature has shown that there is a presence of PMs, which are ignored in many cases. Regarding performance measurement frameworks, the study pointed out the lack of guidelines on the development and selection of PMs. A consistent concern on the external public was indicated, while the sustainability indicators are often composed of dimensions that are not comparable, restrict and even insignificant. Most of the managers do not seem to realise the benefits of improved EP, which in turn has resulted in the loss of many opportunities to reduce environmental costs.

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