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Environmental and managerial information for cleaner production strategies: An environmental management development perspective

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ABSTRACT

This paper examines the uses and characteristics of environmental and managerial information for cleaner production (CP) strategies to achieve corporate sustainability from an environmental management development perspective. Based on a development stage model, an analytical framework was developed to identify the organizational uses and dimension characteristics of information for three different CP strategies, namely, efficiency, consistency and sufficiency. Based on twelve case studies of businesses in Sri Lanka, the uses and characteristics of information are explored at three different environmental management development stages (i.e. functional specialization, internal integration and external integration). Overall, the study found that the organizations at the functional specialization stage, with limited information uses and characteristics, adopt a narrow view of CP strategies by associating them with efficiency. As organizations progress to higher stages of environmental management development, the information uses and characteristics for CP are expanded to encapsulate sufficiency and consistency strategies while strengthening the efficiency uses. Further, the findings show that limited uses and characteristics of information in some respects such as for pricing decisions, internal reporting of environmental aspects (e.g. material, water and waste with the exception of energy) and external collaboration can undermine the efforts of companies to use CP strategies for corporate environmental sustainability.

1. Introduction

Environmental and social responsibility pressures together with market and customer demand have forced companies around the world to follow various strategies in transitioning to a low carbon economy (Cai et al., 2019a). These strategies including cleaner production (CP) aim to achieve corporate sustainability which, in turn, contributes to the realization of sustainable development goals (SDGs) (Bansal, 2005; Henriques and Catarino, 2015). In the matter of CP strategies, the lack of adequate and relevant information has often been pinpointed as a major obstacle to improving organizational performance and achieving sustainable outcomes (Schaltegger et al., 2008; Burritt et al., 2009, 2019; Geng et al., 2010; Zilahy, 2004). For instance, Cai et al. (2019b) emphasize how energy information is required to support energy measurement, monitoring, modelling, optimization and other strategies to promote energy performance. Hence, if businesses take decisions without the requisite information, there will be adverse economic, environmental and social impacts such as inefficient use of resources, pollution, or even disasters (Burritt et al., 2019).

However, the information needs and the intensity of corporate environmental management activities including CP are not consistent and depend largely on the level of sophistication (or development) of the environmental management activities pursued by an organization (Gunarathne and Lee, 2019; Kang and Lee, 2016; Jabbour and Santos, 2006; Kolk and Mauser, 2002; Ormazabal and Sarriegi, 2012). In order to classify the level and intensity of environmental management activities, scholars have suggested various taxonomical explanations of corporate environmental development (or maturity) (Kolk and Mauser, 2002; Gunarathne and Lee, 2019). This view suggests that the information needs, characteristics and uses of corporate environmental management activities are driven by the development stages of environmental management activities. While there has been wide

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academic interest in suggesting different taxonomies and characteristics in environmental management development stages (Gunarathne and Lee, 2019; Jabbour and Santos, 2006; Kolk and Mauser, 2002; Ormazabal and Sarriegi, 2012), information uses and characteristics for CP in organizations at different development stages have yet to be examined.

This matter is important because while academics seek to provide generalizable taxonomies to classify corporate environmental management activities, practitioners have to work with complex problems facing businesses (Burritt et al., 2019). Ignorance especially of the development of corporate environmental activities can render the provision of information unfocused and irrelevant owing to the limited understanding of its uses. This will reduce the effectiveness of planning, implementation, decision making and control of CP programs giving rise to obstacles to achieving SDGs (Schaltegger et al., 2008; Burritt et al., 2009; Gunarathne and Lee, 2015). Nevertheless, there has been little examination of how environmental and managerial information is used by organizations at different levels of intensity of environmental management activities. Such examination could provide a guide to others seeking to introduce CP and moving their operations towards low carbon and sustainable production. It will even help academics to obtain a better knowledge for theorising how and why of the successes, failures and implementation challenges of CP strategies in various organizations. This paper examines the importance of environmental and managerial information for CP strategies for achieving corporate sustainability from an environmental management development perspective and poses the research question: *How do companies use and characterise information for CP in the context of environmental management development?*

The contributions of this study are as follows: First, it combines CP and corporate environmental management from a corporate environmental development perspective to provide other important insights into corporate environmental sustainability. It has been empirically demonstrated that the issue of development stages in environmental management can play an important role in corporate green initiatives such as CP strategy (Gunarathne and Lee, 2019; Hart, 1995; Jabbour and Santos, 2006; Ormazabal and Sarriegi, 2012; Roome, 1992). Second, this study examines the uses and characteristics of information about CP in the development stages of corporate environmental management. Since reliable and accurate information is a prerequisite for CP (Schaltegger et al., 2008; Burritt et al., 2019), we identified the use of environmental information for CP and found that it required information based on CP strategy and the development stages of environmental management. This is one aspect so far ignored in the CP and environmental management literature. Third, this study develops a solid theoretical basis for understanding how CP strategies can be supported with the provision of relevant management accounting information. By highlighting the use of information from such a perspective, our findings shed some light on the usefulness of information for CP and environmental management. Fourth, the research context of this study is a fast-developing South-Asian country -Sri Lanka. Although the field of CP and environmental management has evolved over four decades, small developing economies like Sri Lanka have been ignored in environmental management research including CP (Ciccozzi et al., 2003; Gunarathne et al., 2015; Gunarathne and Lee, 2015; Burritt et al., 2009; Burritt et al., 2019). By providing empirical evidence, we add some new knowledge of and insights into CP and environmental management in the emerging South Asian economic context.

The rest of the paper is organized as follows: Section Two surveys the literature relating to the study by synthesising three areas, namely, CP for corporate environmental management and sustainability, uses and characteristics of information in CP, and corporate environmental development stages. This section also presents the analytical framework by integrating these three areas. Section Three presents the methodology of the study followed by the findings in the next section. Section Five presents the discussion and the last section the conclusion.

2. Literature review

2.1. Cleaner production (CP) for corporate environmental sustainability

Environmental management including CP is of crucial importance for companies as the damage to the natural environment can render present strategies inadequate for identifying important emerging sources of competitive advantage (Hart, 1995). To understand the importance of the natural environment, companies around the world are devising environmental strategies for two main reasons. First, environmental strategies are important for the sustainable development of societies. Second, these strategies help companies to achieve long-term market success while meeting environment-related social, legal, political and economic requirements (Schaltegger et al., 2012; Schaltegger and Burritt, 2018). Accordingly, companies use various methods and tools to achieve environmental sustainability while minimizing negative environmental impacts (Cramer, 1998; Ormazabal and Sarriegi, 2014). With the help of these various tools and applications, environmentally-friendly organizational mechanisms have been included in organizational strategy (Sarkis, 2001), which has now been elevated to a strategic level in many organizations (Ervin et al., 2013). This integration between business and the environment is referred to as "corporate environmental management" (Ormazabal and Sarriegi, 2014) and has now become a fundamental concern of organizations, customers, and citizens (Ormazabal et al., 2017). Over the last two decades helped by the noteworthy initiatives of the United Nations Industrial Organization (UNIDO), the United Nations Environmental Program (UNEP) and many other agencies, CP has become one of the most widely adopted environmental management initiatives of corporations.

In order to implement and achieve CP, three complementary sustainability strategies are mentioned in the literature: efficiency, consistency and sufficiency (Schaltegger et al., 2008). Efficiency aims to improve the economic and ecological efficiency of companies by creating economic value with fewer inputs and less waste (Henriques and Catarino, 2015; Schaltegger et al., 2008). Efficiency focuses on improving economic value while lowering negative environmental impacts. These strategies support the environmental profile by preventing materials, water and energy losses at the origin while reducing functioning costs (Henriques and Catarino, 2015). Consistency strategies focus on replacing environmentally harmful materials and energy flows with more environmentally friendly materials and energy flows (Schaltegger et al., 2008; Schaltegger and Burritt, 2014). Third, the "sufficiency approach is based on the fact that every product which does not have to be produced will not cause harm and will not require a supply chain with harmful impacts" (Schaltegger and Burritt, 2014, p. 236). Hence, sufficiency strategies aim at eliminating products, features or services that are not value adding. Less consumption and the substitution of products with services are the guiding principles of sufficiency (Halldórsson et al., 2009). Together with the CP approach, efficiency strategies, consistency and sufficiency strategies too provide support (Schaltegger et al., 2008).

Although companies have adopted various CP programs to achieve corporate sustainable development, it has been argued that CP programs do not simply guarantee the success of environmental

Table 1
Information uses in supporting CP.

CP strategy	Information uses in supporting CP
Efficiency	• Efficiency improvement decisions • Pricing decisions • Capital investment decisions • Preparing budgets • Setting performance targets • Analysing differences between budgets and actuals • Reporting for external parties [sustainability reports/reporting for competitions] • Internal reporting on efficiency gains • Meeting internal and external standards
Consistency	• Make-or-buy decisions • Equipment replacement decisions • Preparing budgets • Setting performance targets • Analysing differences between budgets and actuals • Product optimization decisions
Sufficiency	• Decisions on dropping product−market combinations • Preparing budgets • Setting performance targets • Analysing differences between budgets and actuals

Source: Adapted from Burritt et al. (2002); Bhimani et al. (2011); Drury (2009); Langfield-Smith et al. (2012); Tillema (2005).

progress unless there are management systems to make these activities continuous and systematic (Bonilla et al., 2010). This underscores the need for proper planning, implementation and control of CP strategies. Therefore, in order to successfully manage the three aforementioned sustainability strategies either in a company or in the wider industrial and societal system managers have to make use of relevant information. However, many previous studies of CP point to the lack of experience in generating environment-related information and integrating environmental and economic information as a major obstacle to the achievement of CP objectives (Burritt et al., 2009; Zilahy, 2004). A major reason for this situation is the non-identification of how the information is used to support various CP strategies. Thus, it is essential to understand how the use of information in supporting CP makes the information more relevant and thereby makes the CP strategies effective. With a view to understanding how information supports CP strategies, the next section discusses the importance of information in supporting CP.

2.2. Importance of information in supporting CP strategies

While the information for CP can be analysed from different perspectives, this study follows an accounting perspective as CP strategies need not only making decisions but also dealing with many other organizational functions. Further, understanding the role and potential for improving accounting information not only becomes a catalyst for CP but also improves organizational competitiveness with better environmental cost information (Schaltegger et al., 2008; Henriques and Catarino, 2015). Further, the lack of a relationship between organizational change as required by CP and accounting change has been a possible reason for the low level of adoption of CP (Broadbent and Laughlin, 2005). In accounting, particularly management accounting, the functional roles of information have been widely discussed and highlighted for planning, decision making, implementation, control and performance evaluation (Drury, 2009; Bhimani et al., 2011). This study reorganizes these functional uses of information in support of three CP strategies: efficiency, consistency and sufficiency (see Table 1). As shown in Table 1, budget preparation, variance analysis through the comparison of budgets and actual results and setting performance targets are the common uses of information across all three CP strategies. Depending on the purpose for which they are used, they will fall into a particular CP strategy.

These uses of information and their importance are largely determined by the characteristics of information provided by the environmental and management information systems of an organization. This suggests that outcomes, as in this case the use of information, depend upon the degree of fit or alignment between an information system and the tasks (or the CP strategy) that must be performed (Weill and Olson, 1989).[1] In management accounting that analyses complexity of the information system, several configurations have been suggested as contingent factors that determine management information system sophistication. They are: environmental uncertainty, strategy, structure, interdependence and span of control (Otley, 2016; Mia and Chenhall, 1994; Chenhall and Morris, 1986; Tillema, 2005). Chenhall and Morris (1986) suggest four dimensions of information characteristics of management accounting information: scope, timeliness, aggregation and integration. Accordingly, scope of management accounting information refers to the dimensions of focus, quantification, and the time horizon (Chenhall and Morris, 1986; Mia and Chenhall, 1994). The second dimension, timeliness, analyses the role of management accounting information in two areas (Chenhall and Morris, 1986): first, the ability to provide information on request, and second, the frequency of reporting, both of which enhance the managers' ability to respond promptly to events. The next dimension, aggregation and integration of management accounting information, considers how the information is aggregated and how it analyses the impact of decisions throughout the sub-units or the whole organization. Table 2 below shows how to identify the information characteristics of management accounting.

The literature points to understanding how the use of information together with information characteristics is critical to the success of corporate environmental management, including CP strategies (Burritt et al., 2002; Gunarathne and Lee, 2015). However, as an organization progresses to a higher level of environmental

[1] This view is widely discussed in contingency theory which suggests that the design and use of information systems including managerial control systems are contingent upon the context of the organizational setting in which these controls operate and function (see Fisher, 1995; Otley, 2016 for more details).

Table 2
Management information sophistication based on information characteristics.

Aspect	Information characteristic
Scope	Provides information relating to possible future events. Provides non-financial production information. Provides information on the broad factors external to an organization.
Timeliness	Provides requested information to arrive immediately upon request. Provides reports frequently on a systematic, regular basis.
Aggregation & integration	Provides information on the different sections/functions of an organization.

Source: Adapted from Tillema (2005); Chenhall and Morris (1986).

management strategies, advanced or sophisticated systems and procedures are needed to deal with the added complexity and scope (as for example required by CP programs) (Gunarathne and Lee, 2019). However, so far, these uses of information about CP have not been analysed in relation to the development stages of corporate environmental management. The next section provides an overview of the different development stages of environmental management and their salient characteristics.

2.3. Environmental management development stages

There are different taxonomical explanations of how a company progresses in its environmental management activities/strategies. It is usually explained as development/maturity stages (Jabbour and Santos, 2006; Kolk and Mauser, 2002; Gunarathne and Lee, 2019). There have been various stages of how a company develops its environmental management strategies over time. Table 3 below shows some of these different stages of the development of environmental management.

These different stages indicate that the development of environmental management tends to follow similar patterns in virtually all companies (Ormazabal and Sarriegi, 2012). Following an analysis of the above taxonomies, this study uses a three-stage model closely based on the taxonomy of Jabbour and Santos (2006), which is based on many other similar models and has been empirically investigated several times (Gunarathne and Lee, 2019). The salient features of the corporate environmental development model adopted in the present study are summarised in Table 4 below:

These stages underscore that an organization enhances its scope and depth of environmental management activities when progressing to higher levels. Accordingly, the scope, intensity and sophistication of CP strategies will change with the development stage of the environmental management activity of an organization. This necessitates changes in how the information is used by an organization across the three CP strategies outlined in this study. By combining the information uses of CP strategies with the aforementioned corporate environmental development stages, the analytical framework of the study can be presented as follows (see Fig. 1):

As shown in Fig. 1, companies in different environmental management development stages (i.e., functional specialization, internal integration and external integration) follow three different CP strategies for corporate sustainability. These different CP strategies have different uses and applications of environmental and managerial information. The two-headed arrow between the CP strategies suggests that the CP strategies are interconnected. These different CP strategies through the effective use of environmental and managerial information contribute to corporate of corporate sustainable development.

3. Method

This study adopted a multiple case study approach to qualitative phenomena as opposed to a quantitative approach so as to allow for an in-depth analysis of the phenomena (Yin, 2013). As advocated by Burritt et al. (2019), case studies can be used as a research strategy for in-depth analysis of decision making and accounting processes in the context of CP. Case studies are particularly suitable for exploring "how and why" research questions that result in more qualitative outcomes than those requiring broad quantitative approaches (Crossan and Berdrow, 2003; Lee, 2009; Yin, 2013).

Overall, the researchers carried out eighteen company case studies as a part of a larger project that explored the corporate sustainability management practices among the companies listed in the Colombo Stock Exchange (CSE) and the member companies of the Ceylon Chamber of Commerce of Sri Lanka. Twelve of them were finally selected for the purpose of the analysis on account of two aspects: the application of some CP programs (such as comprehensive or quick scan CP) in the last three years and provision of accessibility to some internal information required for the study. The industry sector of these twelve companies comprises: plantations [$n = 1$], manufacturing [$n = 2$], apparel [$n = 3$], hotel and tourism [$n = 2$], printing [$n = 1$], engineering [$n = 1$] and diversified [$n = 2$].

Various methods were deployed to gather rich data and cover a wide range of perspectives on these companies. In-depth data was collected on the various CP strategies and the functional uses and characteristics of information by interviewing various personnel. The main respondents of these interviews were persons handling sustainability-related matters including CP. They were mostly team

Table 3
Different stages of environmental management development.

Author(s)	Development stages of environmental management
Roome (1992)	Non-compliance, compliance, compliance-plus, leading edge, excellence
Venselaar (1995)	Reactive, active, proactive
Hart (1995)	Prevention of prevention, environmental management in products, sustainable development
Shrivastava and Hart (1995)	Band-aid, more serious, deep change
Berry and Rondinelli (1998)	Non-compliance, compliance, beyond compliance
Buysse and Verbeke (2003)	Reactive strategy, prevention of pollution, environmental leadership
Jabbour and Santos (2006); Jabbour et al. (2010)	Functional specialization, internal integration, external integration (Reactive, preventive and proactive)
Ormazabal and Sarriegi (2012)	Legislation fulfilment, training, systematization, eco_2, eco-innovative, leading green company
Primc and Čater (2016)	Reactors, defenders, analysers, prospectors

Table 4
Salient features of corporate environmental development in companies.

	Functional specialization stage	Internal integration stage	External integration Stage
Focus	Complying with regulations of stakeholder expectations	Better utilization of inputs and initiation of projects in environmental management	Exploring the opportunities for improving the competitiveness in the external context
Company perception	Additional cost of compliance	Tool for improving eco-efficiency	Means for achieving competitive advantage
Role and support of top management	Limited	Linked to the improvement of eco-efficiency	Continuous

Source: Adapted from Jabbour et al. (2010).

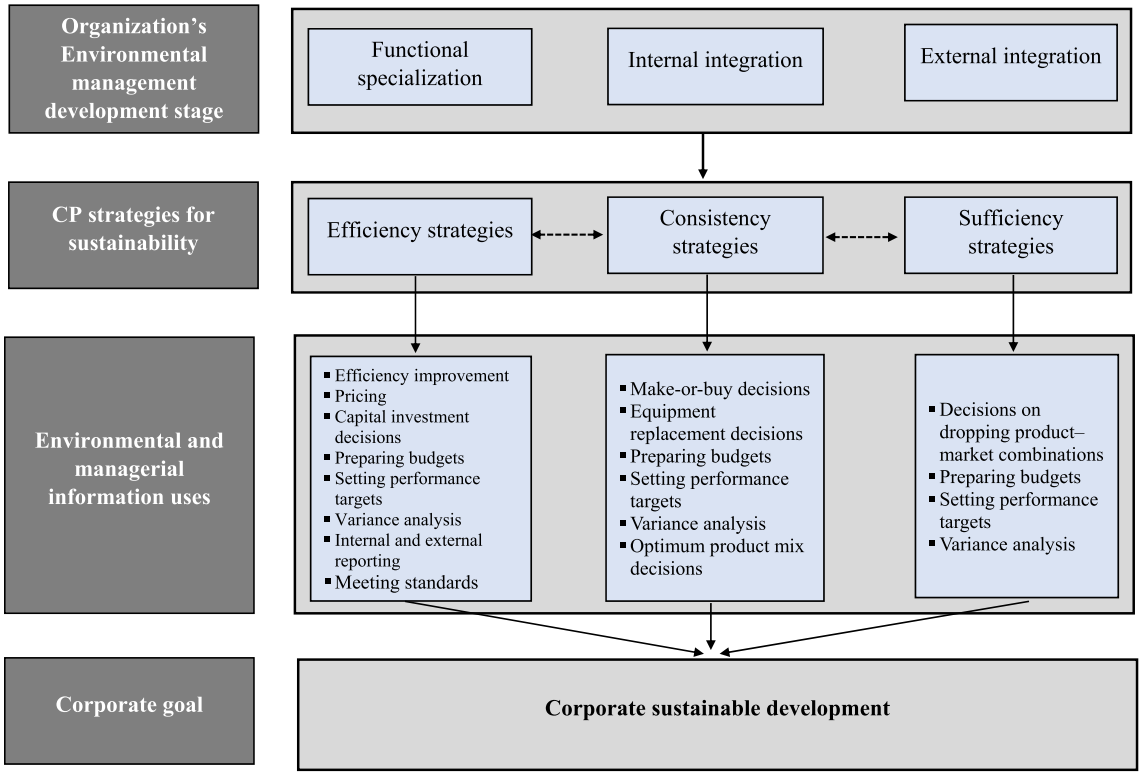

Fig. 1. Analytical framework of the study.

members of the CP such as sustainability managers, engineers or persons in charge of environmental health and safety (EHS), accountants (or finance managers), and production staff. As a means of data collection triangulation, on-site observations and document analyses were carried out (Golafshani, 2003). This was supplemented by an analysis of company web sites, annual reports, and sustainability or integrated reports. With a view to improving the validity of the study, several approaches were used such as interviews with different horizontal and vertical categories of employees, personal observation of environmental-related practices, keeping records and taking photographs, asking probing questions and extensive content analyses of the secondary data (Golafshani, 2003). All the interviews were recorded electronically and later transcribed. Based on the collected data the twelve selected companies were categorized into three environmental management development phases by using the instrument of Jabbour et al. (2010) (see Table 5).

As per the environmental management development stage, the uses of information about these companies were analysed using the analytical framework of the study.

4. Findings

To address the research question 'How do companies use and characterise environmental and managerial information for CP in the context of environmental management development?' information uses and dimensions of information characteristics need to be analysed. Such uses and information characteristics are now considered for the companies in different development levels of corporate environmental management (i.e., functional specialization, internal integration and external integration stages) for three different CP strategies.

4.1. Organizations in the functional specialization stage

4.1.1. Efficiency strategies

Environmental management activities including CP programs of the selected organizations in this stage of environmental management development are focused on compliance with legal requirements, certifications/standards or internal company policies (Jabbour and Santos, 2006; Gunarathne and Lee, 2019).

Table 5
Categorization of the organizations in different environmental management development stages.

Characteristics of corporate environmental management practices	Environmental management development stage	No. Of companies
Focus of environmental management [EM] is to follow environmental legislation EM is predominantly linked to production/manufacturing/operations Majority of EM activities is linked to the adoption of cleaner technologies at the end of the production process	Functional specialization	4
Focus of EM is the efficient use of supplies/raw materials Majority of EM activities is linked to the substitution and more efficient use of supplies/raw materials Support of EM from other company department is started to receive	Internal integration	4
Focus of EM is exploring competitive advantages, such as the creation of environmentally appropriate products and access to new markets EM activities are diffused through the supply chain, influencing the company's suppliers Environmental dimension influences the company's strategy and its long-term objectives	External integration	4

Consequently, their information uses are designed to primarily comply with legislation, certification or internal/external standards. Although the commonly witnessed CP applications were energy, waste and waste water, they depend on the industry and the certification standard followed. For instance, in the hotel sector areas such as food were the focus of CP actions while in the manufacturing and apparel industry, the focus was on environmentally sustainable materials and chemicals. However, these organizations do not consistently follow CP and other environmental management initiatives after the initial CP audit conducted by an external party. Thus, their uses of information in CP are ad-hoc and unsystematic. The production manager of a manufacturing company confirmed this:

"*We identified several CP options after the [CP] audit. However, those things didn't go forward thereafter*."

Interestingly, in some organizations the initial CP audit had been done with the intention of applying for awards. The engineer of an apparel company admitted:

"*We carried out a CP audit in our production division. We simply used CP information to prepare the report for xxx award scheme*."

In the same organization, the division head confirmed:

"*Frankly our purpose of the CP [i.e. audit] was to get some marks for the xx awards. If we carried out a CP audit, we would get some additional marks*."

Although these organizations do not have a clear focus on CP and do not use relevant information, they all endeavour to improve productivity and/or efficiency. Thus, the information use in respect of CP strategies has focused on efficiency improvement decisions. Depending on the industry, the use of information for efficiency improvement differs. For instance, in the hotel sector the primary focus is on improving energy efficiency while in the apparel sector efficiency improvements focus on fabric and other materials used in production. Supporting this view, the manager of a hotel said:

"*Our primary focus of CP is to improve energy [efficiency]. In the cost structure of our hotel's energy costs represent 40–50% in general. We use CP primarily to focus on this aspect*."

A production manager in the apparel sector said:

"*We have a problem of material consumption in our production lines. Since most of the fabrics are exported we need to optimize the use of material. We used CP in our production section to focus on reducing material consumption and waste*."

These views confirm that although these organizations use information pertaining to CP to improve efficiency, their focus is concentrated on one or a few significant cost elements.

Another notable information use of these organizations is to set performance targets for employees. An apparel sector employee said:

We set the performance targets for our production line workers. Although we did this for some time, we could not sustain it as there was no support from HR to provide incentives for those who achieve the targets.

This shows a lack of or absence of support from other functional departments to take the CP initiatives forward. Also, it reveals that although these organizations set KPIs or performance targets there is no internal use of information to assess the achievement of targets or progress. However, this takes place as long as they are stipulated in the legislation/certifications. The production manager of a manufacturing company agreed:

"*We set KPIs that are given in the standards/legislations. Once these KPIs are set we need to monitor the actual progress …. However, once the KPIs [stipulated in the standard/legislation] are achieved we do not worry thereafter*."

Since the legislation and the certifications stipulate the minimum requirements, the scope of CP programs was limited which, in turn, resulted in a limited use of information beyond the requirement of compliance. Confirming this, the manager of a plantation company noted:

"*Our main focus in the use of CP is to satisfy the requirements in the xxx [two industry specific standards]. To maintain these standards, we need to improve our energy consumption and waste generation …. We use the information in CP to meet the requirements of these standards*."

4.1.2. Consistency and sufficiency strategies

Interestingly, none of the selected organizations displayed the use of information for consistency and sufficiency strategies. A careful analysis shows that even budgeting, setting performance targets and variance analysis are motivated primarily by efficiency rather than sufficiency or consistency.

4.2. Organizations in the internal integration stage

4.2.1. Efficiency strategies

These organizations had followed CP and other environmental management strategies for some time and hence identified the potential for improvement. Unlike the organizations involved in functional specialization, the primary focus of the use of information in CP is on improving efficiency, for which purpose they focus not only on a few aspects but also on several important environmental aspects. A hotel environmentalist mentioned:

> "*Earlier when we started we focused on energy. Now we consider energy and food*."

Since the scope of CP is relatively broad, these organizations need the support of several functional departments for their implementation. Accordingly, they communicate the CP and environmental management benefits to other functional departments. This has helped them to garner their support. The production engineer of a diversified organization said:

> "*We wanted to replace the old boiler with a biomass boiler. The finance department and we got together and did the analysis [i.e., an investment appraisal]. They are now positive about some of the things we do for CP … Earlier they were the biggest hindrance for us to implement CP initiatives*."

Due to increased information exchange, the finance departments of these organizations use the information particularly to set budgets. The energy manager of a hotel observed:

> "*We provide energy information to the finance team for inclusion in the annual budget. Also, if we have any major [environmental related] capex we inform the finance team after getting the required top-level management approval*."

A finance team member (who is also a team member of the sustainability committee) in the apparel sector mentioned:

> "*We include the improvements of energy usage and material in the budget. However, the problem is that we still do not have a proper monitoring mechanism to check deviations from the budget … we do it on a quarterly basis, but we need more frequent checks*."

Although the use of information is evident in the areas of budget setting and setting up of key performance indicators (KPIs), the analysis of variances often takes place on a monthly and quarterly basis. In addition, these statements highlight that the organizations at this stage of environmental management development have established links with other departments. This information exchange facilitates the generation of monetary and physical information that is essential for CP and many other environmental management activities.

4.2.2. Consistency and sufficiency strategies

Even though the CP programs of these organizations are fundamentally focused on efficiency strategies, the application of some consistency and sufficiency strategies is also visible. For example, and as discussed earlier under efficiency, some of these organizations have made some equipment replacement decisions to reduce the negative environmental impact of their operations. However, a notable feature is that these CP programs in consistency strategies are primarily energy-related. The engineer of a manufacturing company stated:

> "*We have made some equipment replacement decisions especially changing some machinery, replacing the halogen bulbs with energy-efficient CFL and LED bulbs. When we look at these investments they are all energy-related as we can show the benefits easily.*

The manager of another hotel reported a similar situation with regard to equipment replacement.

> "*We have replaced all the lighting equipment with energy efficient ones in our hotels. The investment was easy to justify*."

However, with regard to other aspects such as water and waste, his response was:

> "*In these areas it is difficult to justify the investment. So far, we are OK with these investments. Maybe in the future we will look into those areas*."

4.3. Organizations in the external integration stage

4.3.1. Efficiency strategies

A notable feature of these organizations is that they have commenced and applied CP and environmental management practices for a considerable time either due to compliance or efficiency gains. Therefore, these practices would have matured over a considerable period of time if they had been consistently applied in these organizations (Gunarathne and Lee, 2015). These organizations have developed the necessary structures, systems, communication mechanisms and reporting procedures to support CP and other environmental management activities. Accordingly, in these organizations there is a separate sustainability team dedicated to sustainability-related matters including environmental management and CP.

Like the organizations in the other two stages, these organizations also focus on efficiency improvement decisions. However, a notable difference is that these organizations have a systematic mechanism for information reporting to the top level. For instance, they use integrated information to report to the top-level management, providing evidence of the use of some aspects of the sustainability balanced scorecard (Figge et al., 2002). Further, another organization uses a sustainability index which combines energy, water, waste and carbon footprint. In explaining the use of the sustainability index, the sustainability manager of an apparel manufacturer stated:

> "*Our sustainability index is an all-in-one indicator for the management to quickly get an understanding of how our sustainability performance is … To calculate the index, we need energy and carbon, water and waste data from the engineering department, waste and water information from the production department and carbon footprint information from the sustainability department*."

In other organizations, management reporting is carried out via internally developed reporting formats that cover almost all environmental aspects. For instance, in a hotel, these aspects cover different types of water, renewable and other types of energy, kitchen and other types of waste, food, chemicals, and other consumables.

These organizations report this information to external parties, not simply on a normative basis but with the objective of generating competitive advantage. They use the information on CP to prepare sustainability and integrated reports and to communicate

with customers, suppliers and other relevant stakeholders online and through print media. The finance director of an engineering company stated:

> "*We frequently obtain CP and other environment- related information to prepare the sustainability report. Not only has it provided information but also provided information that supports improvements in internal systems*."

These internal and external information reporting tools while providing a comprehensive coverage of many environmental aspects also further strengthen the application of CP in the organization.

4.3.2. Consistency and sufficiency strategies

Organizations at this stage use information for several consistency and sufficiency CP strategies. In addition to preparing budgets, variance analyses, and equipment replacements, these organizations use the information to evaluate the environmental impact of their operations and to make product or service discontinuation decisions and make-or-buy decisions. The manager of special projects of a diversified company explained how they made a make-or-buy decision:

> "*We evaluated our packaging production, which has been generating and using some chemicals with high environmental impact. Then we decided to shut it down and buy a similar but more environmentally friendly package from a foreign supplier*."

The Finance Director of an engineering company echoed the application of a discontinuation decision:

> "*We identified that our service operation is generating significant amounts of chemicals which we can't recycle. We finally decided to stop this service. However, we have not seen any considerable drop in the sales of that segment … But we are happy that we reduced our carbon footprint*."

The manager of a printing company held a similar view on the use of a more environmentally friendly approach in their operations:

> "*We now use only the materials approved by the Forest Stewardship Council [FSC] in our production."*

He further explained how the use of information leads to generating a competitive advantage:

> "*It was an increase in the cost. But we now market it on our web site and other company materials. Also, we charge a little premium to cover our [additional] cost*."

The increased coverage of CP and environmental management of these organizations extend beyond internal boundaries. Thus, they use information to monitor their suppliers and intermediaries. The manager of an apparel company stated:

> "*We monitor the suppliers on their environmental and social practices. Even when we dispose of waste we always check whether they follow good environmental practices and obtain the licences*."

5. Discussion

Our analysis reveals some important insights into how the information is used in support of CP strategies by the organizations at different environmental management development stages.

In the functional specialization stage there is fragmentation of the use of information in CP for several reasons. First, these organizations focus only on one significant cost aspect in their CP programs. Second, these organizations do not receive organization-wide support for CP programs, especially of other functional departments. Third, due to the lack of support from top level management, environmental management actions including CP are not system-wide and remain as isolated efforts of the respective departments. This is mainly attributable to the non-provision of CP information for decision making by top management though internal reporting. Hence, these efforts remain isolated resulting in a vicious circle. Fourth, the generation of information is mainly carried out by the engineering, maintenance or production departments, which have their own data collection and recording formats which mainly focus on physical information such as kilograms and energy units, which are not accepted by other departments (Gunarathne, 2015). Therefore, CP is still perceived as a production-oriented technical solution and hence has not yet become "an internal corporate strategy which requires all decision-makers in a company to assess the potential to adopt cleaner technologies and techniques in all parts of the organization" (Schaltegger et al., 2008, p. 5).

These organizations do not have a clear focus on why and how CP is used, and thus their focus is piecemeal. For instance, they endeavour to obtain efficiency gains as long as they are covered by legislation or standards. But thereafter once the targets are achieved their enthusiasm fades away and hence no post-monitoring action is taken. On the other hand, these organizations use information to obtain normative benefits such as marks for green awards or certification without deriving the benefits they offer (Beddewela and Fairbrass, 2016). This is achieved by reporting information about past performance for awards as observed by Gunarathne and Senaratne (2017) for voluntary reporting practices such as sustainability and integrated reporting. Associated with this issue is the inconsistent and often *ad-hoc* use of information. Since the use of information is to satisfy standards from time to time as and when the need arises, there is no continuous application of these in CP. This is due to the absence of clear structures, communication systems and incentives to support CP and other environmental management strategies (Zilahy, 2004). This is clearly evident in these organizations as many of the CP options identified in the CP audits have not been duly implemented.

Compared to organizations in the functional specialization stage, organizations in the internal integration stage have a clear focus in their CP and other environmental management activities. Their focus is on efficiency (Jabbour and Santos, 2006; Jabbour et al., 2010; Gunarathne and Lee, 2019). Unlike organizations in functional specialization, these organizations focus on all or a majority of the cost items to improve efficiency. Hence, they have a wider scope for CP within efficiency strategies. Moreover, as a by-product of these efficiency improvements, they use such information for normative purposes such as applying for green awards. Since these organizations share information with other operational departments they receive support for sustaining some of the CP and environmental management activities. Moreover, these organizations perform variance analyses (i.e., the analysis of the deviations budgeted and actual results) on a regular basis such as monthly or quarterly. This is a notable feature compared to the organizations in the functional specialization stage, which typically do not engage in variance analyses once the requirements of legislation or standards

are met (Gunarathne, 2015). However, when compared with organizations in the external integration stage which perform variance analyses on a daily basis or real time, this is a rare occurrence.

Organizations at the external integration stage use information about CP for generating competitive advantage by using the information in their business strategies. Further, these organizations focus on external reporting of this information such as sustainability reports/integrated reports and reporting on web sites for the same purpose unlike organizations in the functional specialization stage engaged in external reporting for normative purposes or to meet the requirements of legislation (Gunarathne and Lee, 2019). Their effective use of information for internal and external reporting has resulted in a virtuous cycle that strengthens the reporting systems while continuously improving their internal systems and procedures (Gunarathne, 2015). Another prominent feature of the use of information about CP in the organizations in the external integration stage is that they extend beyond the internal boundaries of the organization to other partners in the value chain, especially suppliers and down0stream intermediaries. Their use of environmental information as a means of communication in the value chain has garnered the support of these external parties in generating sustainable competitive advantages (van Hoof and Thiell, 2014). However, organizations in the other two stages use information in supporting CP strategies only within the internal boundaries of the organization.

Our analysis reveals that organizations both in the internal and external integration stages engage in internal reporting with different motives and frequencies. Organizations in the external integration stage use this information consistently to report to top management whereas organizations in the internal integration stage use information on an ad-hoc basis to report to top management. Hence internal reporting is more discretionary in the internal integration stage organizations whereas in organizations in the external integration stage it is mandatory and is a part of the management reporting system of the organization.

Interestingly, the analysis shows that no company in any of the environmental management development stages uses environmental information for pricing decisions. This suggests that environmental cost information is not yet used for differentiation in product pricing, mix and development decisions (Burritt et al., 2002) in developing countries such as Sri Lanka. This is a significant challenge in developing countries resulting from the inadequate and less developed information systems and environmental unawareness in their respective economic, political, social and cultural environment (Ciccozzi et al., 2003; Gunarathne and Lee, 2019; Lee and Schaltegger, 2018). Omission of externalities such as environmental impacts would not reflect the full social cost of the products and services (Viscusi et al., 1994). This invariably leads to pricing inefficiencies as the price of a product or service does not represent the 'right' cost (Drury, 2009).

These information uses can be summarised as shown in Table 6.

Our analysis supports the view that organizations in the functional specialization of CP are synonymous with efficiency (Schaltegger et al., 2008). Hence their focus has been mainly on efficiency strategies. Even in the efficiency strategies, their focus is on a few material cost items. Although the perception and use of CP are largely associated with the efficiency strategy of organizations in the internal integration stage, a notable difference compared with the functional specialization organizations arises as they have wider scope for CP programs. Albeit, not in full, these organizations also follow some consistency and sufficiency strategies. However, their consistency strategies have clearly focused on energy-related CP programs for several reasons. First, unlike waste and water, monetization of energy-related physical information is easy. For instance, calculating the energy cost savings is a straightforward matter where kilowatts are converted to a financial value by using the energy rate for a kilowatt hour. This facilitates communication of information about CP across organizational members from different backgrounds and different hierarchical levels (Cai et al., 2019b). Second, in the Sri Lankan context, energy cost represents a significant portion regardless of the industry or nature of operations (Gunarathne and Lee, 2015). Thus, there is heightened attention and support for any activity that reduces energy costs. Hence, the use of energy measures can be witnessed in energy measurement, monitoring, modelling, optimization and other strategies to promote energy performance (Cai et al., 2019b). This enhanced focused on energy management not only results in savings of energy but also reductions in emissions and production benefits (Cai et al., 2019a). Our analysis thus leads us to assume that when the development level of environmental management advances, organizations try to focus more on sufficiency and consistency strategies while strengthening their efficiency strategies.

By analysing the information uses and their characteristics from a management accounting information sophistication perspective (Chenhall and Morris, 1986; Mia and Chenhall, 1994), Table 7 summarises the findings as follows:

6. Conclusions

This study sought to identify the importance of environmental and managerial information in supporting CP strategies in corporate sustainability from an environmental management development perspective. By combining a management accounting perspective on the uses and characteristics of information with environmental management development this study developed an analytical framework.

Overall, the study arrived at several key conclusions. First, the study revealed that due to the fragmented and ad-hoc use of information by the organizations in the functional specialization stage, CP is associated with efficiency strategies. These organizations therefore perceive CP strategies as a production-oriented solution (Schaltegger et al., 2008) while ignoring the other broader benefits of CP initiatives. This limited view fosters a vicious cycle for CP, where CP remains an isolated effort of some production-oriented departments such as engineering, maintenance or production without the top management and organization wide support. Consequently, the organizations in the functional specialization stage of environmental management development make only a limited contribution of CP to the realization of SDGs.

Second, the study found that as organizations progress to higher stages of environmental management development, CP strategies are expanded to encompass sufficiency and consistency strategies while strengthening their efficiency strategies. With this enhanced scope of CP strategies, these organizations tend to make a larger contribution to the achievement of SDGs in their CP-related corporate environmental management activities. Particularly the organizations in the external integration phase, with their wide use of information, enjoy a virtuous cycle which fosters continuous improvement in internal systems, procedures and external reporting of CP. As Burritt el al. (2019) opine, the application of one environmental tool in CP leads to an information situation that encourages and shows relevance for further kinds of information in these organizations.

Third, from an information communication perspective, the study provides evidence that the use of CP information by the organizations in the early stages of environmental management development is confined to internal organization boundaries resulting in a lack of collaboration with supply chain partners for CP actions. As van Hoof and Thiell (2014) clearly point out this limited

Table 6
Information uses in supporting CP strategies.

CP strategy	Information uses	Environmental management development stage		
		Functional specialization	Internal integration	External integration
Efficiency	• Efficiency improvement decisions	x	x	x
	• Pricing decisions			
	• Capital investment decisions			x
	• Preparing budgets		x	x
	• Setting performance targets	x	x	x
	• Analysing differences between budgets and actuals		x	x
	• Reporting for external parties	x	x	x
	• Internal reporting		x	x
	• Meeting internal and external standards	x	x	x
Consistency	• Make-or-buy decisions			x
	• Equipment replacement decisions			x
	• Preparing budgets		x	x
	• Setting performance targets		x	x
	• Analysing differences between budgets and actuals			x
	• Product optimization decisions		x	x
Sufficiency	• Decisions on dropping product−market combinations			x
	• Preparing budgets		x	x
	• Setting performance targets		x	x
	• Analysing differences between budgets and actuals			x

Table 7
Information characteristics in CP.

Aspect	Information dimension	Environmental management development stage		
		Functional specialization	Internal integration	External integration
Scope	Nature of information	Physical	Physical/monetary	Physical and monetary
	Time period of information	Past	Mostly past with some future	Future and past
	Internal or external	Internal	Internal	Internal and external
Timeliness	Frequency of information use	Ad-hoc	Ad-hoc and routine	Routine
	Time period of information	Short term	Short and long term	Long term
Aggregation and integration	Presentation of information	Fragmented	Fragmented	Integrated

contribution of supply chain partners will deprive organizations in functional specialization and internal integration phases of "strengthening knowledge absorption capacity, structuring solutions, and motivating activity around a commonly defined problem or goal such as CP" (p. 239).

Fourth, the study found no organization irrespective of their level of development of environmental management uses CP information in pricing decisions. While this reflects a lack of environmental cost information systems and environmental awareness particularly in the context of developing countries such as Sri Lanka, it also highlights the prevalence of incorrect product or service pricing due to the ignorance of externalities such as environmental impacts (Viscusi et al., 1994; Drury, 2009).

Fifth, this study highlights the extensive use of energy information across efficiency and sufficiency strategies of CP. Ease of monetization, the high proportion of energy cost in the cost structure and managerial motivation for cost savings are the main drivers of the enhanced use of information related to energy that not only results in the conservation of energy but also in the reduction of emissions (Cai et al., 2019a, 2019b; Gunarathne and Lee, 2015). However, this interest in and use of information are not reflected in managing other important environmental aspects such as waste, water and material.

By analysing the information uses in supporting CP strategies, this study offers several practical implications. First, it highlights CP including environmental management as contributors to SDGs requiring organization-wide systems, structures and internal and external communication mechanisms. As "CP practices may not result in a transformation in the short run without the integration of environmental, economic and social dimensions in innovations in the companies' managerial systems" (Almeida et al., 2017), the responsibility lies with top management to make the necessary changes internally to facilitate the organizational transition for corporate sustainability. Second, that organizations in all stages use information about CP to apply for awards highlights the importance that Sri Lankan organizations place on normative schemes (Gunarathne and Senaratne, 2017). Inclusion of measures to assess how these reported aspects are internally implemented for the purpose of awards schemes can have a significant normative impact on the environmental performance of companies. It is the responsibility of regulators, professional institutions and other trade associations to incorporate these criteria in the award schemes to motivate Sri Lankan organizations to improve their environmental performance. Next, the study points to the need for capacity building in information management for sustainability through requisite educational, institutional and policy level reforms. High quality, timely and reliable information can act as a catalyst for instigating organizational, industrial and national level sustainability-related improvements. As SDG 17.18 and 17.19 emphasize, this capacity-building is an important aspect because the lack of requisite information has been a major challenge for policy formulation, monitoring and assessment of the achievement of SDGs in developing countries such as Sri Lanka (Gunarathne and Lee, 2019).

Notwithstanding the useful insights into how information is used in supporting CP strategies, this study must also be viewed as consisting of several limitations. First, it covers a limited number of qualitative cases studies selected from Sri Lanka, which can limit the generalizability of its findings (Yin, 2013). The findings of this study thus can only be theoretically generalized in a contextual way (Lukka and Kasanen, 1995). This calls for future studies using survey methods with a wide sample base to enable conclusions on a national or regional level on how information is pursued in CP, possibly in developing and developed countries based on a comparative analysis. Second, this study posited the environmental management development stage as a contingent variable that decides how managers use environmental information for CP and other environmental management purposes. However, as argued in contingency theory there can be other variables such as industry, organizational size, technology, level of decentralization and quality of management that can affect the contingency 'fit' (Christ and Burritt, 2013; Otley, 2016). Future studies can consider the effect of these other variables on environmental management information systems and their uses. Further, this study collected data from the participating companies at a single point of time. However, as these organizations continuously evolve in respect of environmental management strategies, their information uses in supporting CP can change over time or the information use itself can change the environmental management development stage. As McPhee (1990) points out, many process studies end with a theory in terms of stages, with different event types (as in this case, the uses of information in supporting CP strategies) falling into each stage. However, as phase (or stage) transitions are created by events, it will be interesting for future researchers to identify, through longitudinal case studies, how the information uses lead to environmental management phase development.

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References

Almeida, C.M., Agostinho, F., Huisingh, D., Giannetti, B.F., 2017. Cleaner production towards a sustainable transition. J. Clean. Prod. 142, 1–7.
Bansal, P., 2005. Evolving sustainably: a longitudinal study of corporate sustainable development. Strateg. Manag. J. 26 (3), 197–218.
Beddewela, E., Fairbrass, J., 2016. Seeking legitimacy through CSR: institutional pressures and corporate responses of multinationals in Sri Lanka. J. Bus. Ethics 136 (3), 503–522.
Berry, M.A., Rondinelli, D.A., 1998. Proactive corporate environmental management: a new industrial revolution. Acad. Manag. Exec. 12 (2), 38–50.
Bhimani, A., Horngren, C.T., Datar, S.M., 2011. Management and Cost Accounting. Prentice Hall International, New York.
Bonilla, S.H., Almeida, C.M., Giannetti, B.F., Huisingh, D., 2010. The roles of cleaner production in the sustainable development of modern societies: an introduction to this special issue. J. Clean. Prod. 18 (1), 1–5.
Broadbent, J., Laughlin, R., 2005. Organisational and accounting change: theoretical and empirical reflections and thoughts on a future research agenda. J. Account. Org. Change 1 (1), 7–26.
Burritt, R.L., Hahn, T., Schaltegger, S., 2002. Towards a comprehensive framework for environmental management accounting—links between business actors and environmental management accounting tools. Aust. Account. Rev. 12 (27), 39–50.
Burritt, R.L., Herzig, C., Tadeo, B.D., 2009. Environmental management accounting for cleaner production: the case of a Philippine rice mill. J. Clean. Prod. 17 (4), 431–439.
Burritt, R.L., Herzig, C., Schaltegger, S., Viere, T., 2019. Diffusion of environmental management accounting for cleaner production: evidence from some case studies. J. Clean. Prod. 224, 479–491.
Buysse, K., Verbeke, A., 2003. Proactive environmental strategies: a stakeholder management perspective. Strateg. Manag. J. 24 (5), 453–470.
Cai, W., Lai, K.H., Liu, C., Wei, F., Ma, M., Jia, S., Jiang, Z., Lv, L., 2019. Promoting sustainability of manufacturing industry through the lean energy-saving and emission-reduction strategy. Sci. Total Environ. 665, 23–32.
Cai, W., Liu, C., Lai, K.H., Li, L., Cunha, J., Hu, L., 2019. Energy performance certification in mechanical manufacturing industry: a review and analysis. Energy Convers. Manag. 186, 415–432.
Chenhall, R.H., Morris, D., 1986. The impact of structure, environment, and interdependence on the perceived usefulness of management accounting systems. Account. Rev. 61 (1), 16–35.
Christ, K.L., Burritt, R.L., 2013. Environmental management accounting: the significance of contingent variables for adoption. J. Clean. Prod. 41, 163–173.
Ciccozzi, E., Checkenya, R., Rodriguez, A.V., 2003. Recent experiences and challenges in promoting cleaner production investments in developing countries. J. Clean. Prod. 11 (6), 629–638.
Cramer, J.M., 1998. Environmental management: from 'fit' to 'stretch'. Bus. Strateg. Environ. 7 (3), 162–172.
Crossan, M.M., Berdrow, I., 2003. Organizational learning and strategic renewal. Strateg. Manag. J. 24, 1087–1105.
Drury, C., 2009. Management Accounting for Bubsiness. Cengage Learning, Andover.
Ervin, D., Wu, J., Khanna, M., Jones, C., Wirkkala, T., 2013. Motivations and barriers to corporate environmental management. Bus. Strateg. Environ. 22, 390–409.
Figge, F., Hahn, T., Schaltegger, S., Wagner, M., 2002. The sustainability balanced scorecard–linking sustainability management to business strategy. Bus. Strateg. Environ. 11 (5), 269–284.
Fisher, J., 1995. Contingency-based research on management control systems: Categorization by level of complexity. J. Account. Lit. 14, 24–53.
Geng, Y., Xinbei, W., Qinghua, Z., Hengxin, Z., 2010. Regional initiatives on promoting cleaner production in China: a case of Liaoning. J. Clean. Prod. 18 (15), 1502–1508.
Golafshani, N., 2003. Understanding reliability and validity in qualitative research. Qual. Rep. 8 (4), 597–607.
Gunarathne, N., 2015. Fostering the adoption of environmental management with the help of accounting: an integrated framework. In: Rahim, M.M., Idowu, S. (Eds.), Social Audit Regulation. Springer, Cham (ZG), pp. 301–324.
Gunarathne, N., Peiris, S., Edirisooriya, K., Jayasinghe, R., 2015. Environmental Management Accounting in Sri Lankan Enterprises. Department of Accounting, University of Sri Jayewardenepura, Sri Lanka.
Gunarathne, N., Lee, K.H., 2015. Environmental management accounting (EMA) for environmental management and organizational change: an eco-control approach. J. Account. Organ. Chang. 11 (3), 362–383.
Gunarathne, N., Lee, K.H., 2019. Institutional pressures and corporate environmental management maturity. Manag. Environ. Qual. Int. J. 30 (1), 157–175.
Gunarathne, N., Senaratne, S., 2017. Diffusion of integrated reporting in an emerging South Asian (SAARC) nation. Manag. Audit J. 32 (4/5), 524–548.
Halldórsson, Á., Kotzab, H., Skjoett-Larsen, T., 2009. Supply chain management on the crossroad to sustainability: a blessing or a curse? Int. J. Phys. Distrib. Logist. Manag. 1 (2), 83–94.
Hart, S.L., 1995. A natural-resource-based view of the firm. Acad. Manag. Rev. 20 (4), 986–1014.
Henriques, J., Catarino, J., 2015. Sustainable value and cleaner production–research and application in 19 Portuguese SME. J. Clean. Prod. 96, 379–386.
Jabbour, C.J.C., Santos, F.C.A., 2006. The evolution of environmental management within organizations: toward a common taxonomy. Environ. Qual. Manag. 16 (2), 43–59.
Jabbour, C.J.C., Santos, F.C.A., Nagano, M.S., 2010. Contributions of HRM throughout the stages of environmental management: methodological triangulation applied to companies in Brazil. Int. J. Hum. Resour. Manag. 21 (7), 1049–1089.
Kang, S., Lee, K.H., 2016. Mainstreaming corporate environmental strategy in management research. Benchmarking: Int. J. 23 (3), 618–625.
Kolk, A., Mauser, A., 2002. The evolution of environmental management: from stage models to performance evaluation. Bus. Strateg. Environ. 11 (1), 14–31.
Langfield-Smith, K., Thorne, H., Hilton, R.W., 2012. Management Accounting: Information for Creating and Managing Value. McGraw-Hill Higher Education, Australia.
Lee, K.H., 2009. Why and how to adopt green management into business organizations? Manag. Decis. 47 (7), 1101–1121.
Lee, K.H., Schaltegger, S., 2018. Accounting for Sustainability: Asia Pacific Perspectives. Springer, London and New York.
Lukka, K., Kasanen, E., 1995. Methodological themes: the problem of generalizability: anecdotes and evidence in accounting research. Account. Audit. Account. J. 8 (5), 71–90.
McPhee, R.D., 1990. Alternate approaches to integrating longitudinal case studies. Organ. Sci. 1 (4), 393–405.
Mia, L., Chenhall, R.H., 1994. The usefulness of management accounting systems, functional differentiation and managerial effectiveness. Account. Org. Soc. 19 (1), 1–13.
Ormazabal, M., Sarriegi, J.M., 2012. Environmental management: understanding its evolution through maturity states. Environ. Qual. Manag. 22 (1), 31–42.
Ormazabal, M., Sarriegi, J.M., 2014. Environmental management evolution: empirical evidence from Spain and Italy. Bus. Strateg. Environ. 23 (2), 73–88.
Ormazabal, M., Rich, E., Sarriegi, J.M., Viles, E., 2017. Environmental management evolution framework: maturity stages and causal loops. Organ. Environ. 30 (1), 27–50.
Otley, D., 2016. The contingency theory of management accounting and control: 1980–2014. Manag. Account. Res. 31, 45–62.
Primc, K., Čater, T., 2016. Environmental strategies in different stages of

organisational evolution: theoretical foundations. Australas. J. Environ. Manag. 23 (1), 100–117.
Roome, N., 1992. Developing environmental management strategies. Bus. Strateg. Environ. 1 (1), 11–24.
Sarkis, J., 2001. Manufacturing's role in corporate environmental sustainability - Concerns for the new millennium. Int. J. Oper. Prod. Manag. 21, 666–686.
Schaltegger, S., Bennett, M., Burritt, R.L., Jasch, C., 2008. Environmental management accounting (EMA) as a support for cleaner production. In: Schaltegger, S., Bennett, M., Burritt, R.L., Jasch, C. (Eds.), Environmental Management Accounting for Cleaner Production. Springer, Dordrecht, pp. 3–26.
Schaltegger, S., Burritt, R., 2014. Measuring and managing sustainability performance of supply chains: review and sustainability supply chain management framework. Supply Chain Manag.: Int. J. 19 (3), 232–241.
Schaltegger, S., Burritt, R., 2018. Business cases and corporate engagement with sustainability: differentiating ethical motivations. J. Bus. Ethics 147 (2), 241–259.
Schaltegger, S., Lüdeke-Freund, F., Hansen, E.G., 2012. Business cases for sustainability: the role of business model innovation for corporate sustainability. Int. J. Innov. Sustain. Dev. 6 (2), 95–119.
Shrivastava, P., Hart, S., 1995. Creating sustainable corporations. Bus. Strateg. Environ. 4 (3), 154–165.
Tillema, S., 2005. Towards an integrated contingency framework fro MAS sophistication: case studies on the scope of accounting instruments in Dutch power and gas companies. Manag. Account. Res. 16 (1), 101–129.
van Hoof, B., Thiell, M., 2014. Collaboration capacity for sustainable supply chain management: small and medium-sized enterprises in Mexico. J. Clean. Prod. 67, 239–248.
Venselaar, J., 1995. Environmental training: industrial needs. J. Clean. Prod. 3 (2/3), 9–12.
Viscusi, W.K., Magat, W.A., Carlin, A., Dreyfus, M.K., 1994. Environmentally responsible energy pricing. Energy J. 15 (2), 23–42.
Weill, P., Olson, M.H., 1989. An assessment of the contingency theory of management information systems. J. Manag. Inf. Syst. 6 (1), 59–86.
Yin, R., 2013. Case Study Research: Design and Methods. Sage, Thousand Oaks, CA.
Zilahy, G., 2004. Organisational factors determining the implementation of cleaner production measures in the corporate sector. J. Clean. Prod. 12 (4), 311–319.