



## Developing a Model for Clean Production in Management Accounting Based on Grounded Theory and Thematic Analysis

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### ABSTRACT

**Background and purpose:** The purpose of this study was to design a model for developing a cleaner production strategy of the company based on environmental management accounting.

**Research method:** Data collection was done through interviews. In this part of the research, 15 interviews were conducted with the participants. Also in this part of the research, theoretical sampling method has been used. Data analysis was performed using the Strauss and Corbin approach in three stages of open coding, axial coding and selective coding using NVivo and Maxqda software.

**Findings:** In general, this study showed that in the basic, preventive and operational stages, using environmental management accounting, resources can be managed in line with the company's cleaner production strategy, and the company's effectiveness and performance can also be improved. In addition, the company's goals can be controlled and monitored through the use of environmental management accounting.

**Conclusion:** Generally the results of this research are indicating that the uses of environmental management accounting in the initial stages of development of cleaner production strategy would lead to cost saving and the improvement of the companies' efficiency; in fact, the high level of using environmental management accounting for the purpose of decision makings about the improvement of the cost management and organization, would have a significant efficiency.

**Keywords:** Management Accounting, Environmental Issues, Cleaner Production Strategy, Grounded Theory and Thematic analysis.



## 1. Introduction

One of the relevant factors of the legitimacy theory is the sensitivity of the company to the environmental issues disclosure. Indeed, companies with raw materials, such as chemical, petrochemical, metals, mines, etc., that are directly extracted from natural resources are environment-sensitive companies and are more exposed to the consumer, and they have to disclose their environmental and social activities in order to be socially accountable (Pourkhani Zakle Beri and Jahanshad, 2021: 180). In order to support corporate decision-making for cleaner production actions, organizations have attempted to support different new approaches and tools. One of the methods which has received the attention of academics and researchers is environmental management accounting (EMA) (Schaltegger et al., 2008; Burritt et al., 2019, 480). Corporate environmentalism is of great importance from a theoretical and practical point of view, and perceiving its determinants and consequences has been the subject of many researches in the past two decades. Nowadays, companies cannot only rely on their intangible assets such as technical knowledge, networks, procedures and information systems, but also tend to develop public natural resources via their actions such as environmental protection (Asiaei et al., 2022: 76). With the expansion of many environmental regulations worldwide, there are growing concerns regarding the effect of the commercial activities of the companies on the environment (Christ and Burritt, 2013: 164 and Mokhtar et al., 2016: 112). Environmental issues refer to the debated that companies' duty to society and beyond it is described in law. In fact, the important view here is that environmental activities are described as activities that should go beyond their financial objectives in order to promote some social goals (Cheng et al., 2014: 2). Hence, many companies have attempted to include environmental information in their business strategies.

As a result, the execution of environmental management accounting (EMA) has become a common method, as it enables companies to make informed decisions and contributes to overcome the shortcomings of traditional management accounting (Christ and Burritt, 2013: 164 and Ferdous et al., 2019: 985). Environmental protection problems are a challenge for which there is no unified policy. However, a combination of existing opportunities and

increased efficiency and monitoring of environmental processes can be useful (Dugaro, 2013: 1966). On the one hand, environmental issues have always been one of the debates that have involved public institutions and have a unique position in the theoretical literature of public administration due to their effect on society and its extensive spectrum and on the other hand, it can be useful for companies.

Environmental management accounting can assist companies to perform their environmental responsibilities and this leads to the identification of economic advantages of improved environment and economic performance (Ferreira et al., 2010: 33). Environmental management accounting is useful for monitoring environmental costs and recording the environmental performance of companies (Burritt and Saka, 2006: 1263).

The environmental performance improvement of companies and disclosure of social responsibility reduces the companies' risks (Sarlak et al., 2020: 58). Besides, providing environmental information can improve the environmental and financial performance of companies (Zhou et al., 2017: 111). The aim of environmental management accounting and environmental accounting is to provide information to help managers in the assessment of control, decision making, performance and reporting for a company or organization. Environmental accounting is based on environmental and economic criteria, concepts and values (Haiderpour and Qarani, 2015: 40). As the link between management accounting and the environmental strategies of the company such as cleaner production, environmental management, accounting plays a crucial informational role in the company's sustainable development. Specifically, when companies adopt cleaner production strategies, environmental management accounting with a set of accounting tools provides managers with relevant economic and environmental information for decision making and performance evaluation. In fact, with the development of environmental management accounting, various studies have investigated the current condition of environmental management accounting applications in different industries. Thus, the identification of the factors determining the current state of environmental management accounting is an important aspect of investigations (Gunaratne and Lee, 2021: 1).

The present study aimed to present an environmental management accounting model (EMA) with the purpose of developing a company's cleaner production strategy. Three different levels of cleaner production strategy development have been investigated in this research (reactive, preventive and active stages) which can have different uses. In fact, the purpose of these classifications is to systematize different aspects of the relationship between companies and the environment, and these models explain how organizations integrate environmental measures and cleaner production into the management activities of an organization.

Among the innovations of this research, dealing with the issue of cleaner production according to the characteristics of this concept includes providing environmental solutions and strategies, and it is clear that the promotion and application of this concept in the industries of developing countries can greatly reduce energy consumption. On the one hand, it leads to the improvement of environmental conditions on the other hand. Such cleaner production techniques are mostly low-cost and suitable for the industries of developing countries. On the other hand, the exploratory investigation of the concept of "cleaner production strategy development" using Grounded Theory and Thematic Analysis another innovation of this research.

### **Theoretical basics and background**

A company which is based on sustainability is the one that is developed over time by managing the economic, social and environmental dimensions of its performance and activities. Therefore, a company's sustainability relies on the sustainability of relationships with its stakeholders. A company should consider not only shareholders, employees and customers, but also suppliers, government officials, local communities, internal communities, owners and financial partners. Today, the quality of relations with stakeholders, which is the same as sustainability, can be the directing principle for managers' decision-making and the main element of a comprehensive corporate strategy (Perrinil and Tencati, 2006: 3). Thus, sustainability reporting deals with the nature and relevance between environmental, social and economic issues. GRI standards create a common loss for organizations and stakeholders, which can be adopted to show and understand the economic,

environmental, and social effects of organizations. The researches that have been performed so far on the components of sustainability have indicated the effect of social and environmental sustainability on business strategies and investment analysis. The investment managers and financial analysts extend the sustainability factors to the future perspective of the company and develop the competitive advantage (Liang and Renneboog, 2017: 854). Indeed, continuous changes in the business environment in general and the competition nature and production technology in particular have created many problems for management in all industries to cope up with and adapt to these changes. Today, operational strategy experts recommend that the company should have an effective operational strategy among its competitors in the competitive market (Yaghtin and Abbasi, 2018: 149). However, one of the environmental values at the international competition arena is the capability to create a relative and competitive advantage in a dynamic and ever changing environment and to join the group of pro-environmentalists in current industry.

Today, one of the important parameters of industrial processes is green production. Considering the green brand by producers creates competitive power at the level of global organizations. Environmental concerns need an acceptable focus which is considered as "sustainable development". By elevating environmental protection awareness, organizations are obliged to adopt certain environmental methods with the real intention of protecting their environment and in order to produce green products in their organization (Dehghannayyeri et al., 2016: 46). The environment protection policies can reduce environment learning costs (Garossi et al., 2019: 56). The cleaner production process is considered an environmentally friendly approach that attempts to reduce the environmental pollution of industrial processes by reducing waste and energy consumption, etc. in order to provide the sustainable production in industrial units (Asadzadeh et al., 2017: 573).

In other words, cleaner production as a global strategy with some methods such as improving processes can mitigate the consumption of raw materials, energy, waste, production costs and environmental pollution and increase competitiveness and sustainable development in industries (Asdegi et al., 2021: 34). In this regard, some researches have

also been performed in various industries, including, Evans and Hammer (2003), who investigated the use of cleaner production at the Asian Development Bank (ADB) and found that for the development of Asian countries, the concept of cleaner production should be considered in the national and state policies, technology development, information exchange and private sector investment. The promotion of production in the investment of Asia's new industries, especially small and medium-sized industries, is measured by the development of cleaner production components. This issue, which is the basis for the policies development related to members of developed countries, is the main goal of the ADB. In order to improve the environmental quality of Asia, they consider it essential to decrease the use of resources and pollution, in which monitoring the production, distribution and consumption of goods with the approach of economic and environmental structure of sustainable development are necessary. Also, Avsar and Dennirer (2008), in their assessment of the cleaner production of the Turkish pulp and paper mill, examined the different parts of the paper mill and its pollution load according to the cases of cleaner production and made a comparison with other companies in the USA, Australia, Canada and Europe. They determined the waste reduction measures and the increase of production efficiency and the pollution load of the materials from the mill. Generally, cleaner production is a practical and preventive way to manage energy and environment in industries. The goal of cleaner production is to solve the problems caused by excessive energy consumption, materials, water, etc. in processes, products and services that are environmental- friendly and economical. It is necessary to assess and adopt a cleaner production strategy in countries like Iran in which the excessive use of natural resources by industrial processes is prevalent. The low efficiency and waste of raw materials and high energy of Iranian industries lead to an increase in the price of the product. Besides resolving these problems in domestic industries, the use of cleaner production tools can have a great effect on improving technology, mitigating the environmental crisis, reducing energy consumption, and achieving sustainable development in Iranian industries (Asadzadeh et al., 2017: 574).

The cleaner production strategy with three characteristics of continuous, dynamic and preventive

regarding the pollution creation at the source and inclusiveness are effective on improving the performance of all processes. By adopting cleaner production models, processes and products are consistent with continuous improvement and many economic and environmental advantages are granted to industrial units. In order to use cleaner production models, industrial units need to change their attitude, adopt appropriate technical knowledge and improve technology. The technology improvement models are possible by changing processes, change or improve raw materials, change the final product, and reuse materials in industrial units (Asadgi et al., 2021: 40). There are different definitions and classifications on how a company develops in its environmental management indicators/strategies including cleaner production of the company. It is usually considered as development/maturity stages (Gunarathne and Lee, 2019: 158). The purpose of these classifications is to systematize the different aspects of the relationship between companies and the environment, and also to present a model that can explain the integration method of environmental and cleaner production indicators of the managerial activities of an organization.

These diverse maturity models show a range of environmental reactivity, in which companies only meet the regulatory requirements for environmental proactivity and also where firms take voluntary measures to reduce environmental impacts (Gunarathan and Lee, 2021: 2). All of these development perspectives show a higher level of integration of cleaner and environmental production strategies over time and , consisting of a wide range of organizational activities while investing significant organizational resources. These development stages can help organizational systems and structures, reporting boundaries, applications and information collection, and finally decision-making (Gunarathan and Lee, 2019: 158). These development stages all indicate evolution in environmental management and cleaner production measures following more or less similar patterns in all companies. Most of these classification models consider three stages of environmental management and cleaner production strategy development: reactive, preventive, and proactive (Gunarathan and Lee, 2021: 2). In this study, the model of environmental management and the development of a cleaner production strategy is

presented based on three stages of basic measures, preventive measures and operational measures.

Uyar (2020), conducted a study "The association between environmental strategies and sustainability performance in the context of environmental management accounting ". It was found that environmental strategies have a positive relationship with sustainable performance. Also, the results indicate that the positive impact of strategies on sustainable development is increased through the data generated by the environmental management accounting system. Zhang et al. (2021), in a research investigated the role of environmental law enforcement in the capital market and the effect of transparency and corporate governance on this relationship. To do this, 6527 company-years (observations) were examined during the years 2014-2018. Their results showed that there is a negative relationship between the enforcement of environmental law and the stock price crash risk. Also, they found that transparency and corporate governance have a significant effect on the relationship between environmental law enforcement and the stock price crash risk. Gunarathne, Lee (2021) conducted a research "Environmental management accounting model with the aim of developing a company's cleaner production strategy. For this purpose, 18 Sri Lankan companies were interviewed. They showed that environmental management accounting uses to be limited and fragmented in organizations at the reactive and preventive stages except for using environmental management accounting for cost savings and efficiency improvements. However, the findings suggest that when organizations progress into higher levels of cleaner production strategy development, there is a relatively high level of use of environmental management accounting in terms of integrated tools and for control and monitoring purposes. Asiaei et al. (2022), conducted a research " Green intellectual capital and environmental management accounting: Natural resource orchestration in favor of environmental performance ". The data of this research was collected using a survey of 106 chief financial officers (CFO) of publicly listed companies in Iran. The findings suggest that the elements of green intellectual capital (green human capital, green structural capital and green relational capital) are positively associated with environmental management accounting. Also, the findings support the hypothesis

that the use of environmental management accounting mediates the relationship between green intellectual capital and environmental performance. Gunaratan et al. (2022) performed a study "Tackling the integration challenge between environmental strategy and environmental management accounting ". The data of this research was collected through a survey through the website of Sri Lankan joint stock companies. This study shows that the environmental management accounting implementation is significantly different among organizations at varying stages of environmental management maturity. In addition, the results showed that organizations in higher stages of environmental management maturity use domain-based environmental management accounting tools and environmental management accounting for functional purposes. Therefore, the results suggest that as organizations progress from reactive to proactive environmental strategies, environmental management accounting evolves to be more diverse to deal with more sophisticated environmental management activities.

## **Research methodology**

The method of this research is applied and developmental based on purpose and descriptive-survey with a grounded theory and thematic analysis approach in terms of nature. It analyzes a combination of library and field methods including survey, observation, and open interview in data collection and data analysis using Maxqda and NVivo software. The statistical population of this research is 15 specialists in the field of national planning and experts and university professors who are informed and knowledgeable in this accounting field and they are chosen based on the subject area. A total of 15 semi-structured interviews were carried out using open-ended questions between 25 and 60 minutes. In order to achieve reliability and increase credibility, from the very beginning of data collection and conducting interviews, it was attempted to share the results of the interviews with the participants so that the interpretation of the data was done correctly as desired by the participants. Also, after analyzing and coding the interviews and other data groups, the results were shared with some experts. The work process was reviewed and corrected by the expert to investigate the methodology and to ensure that the research is based on the strategies of the grounded theory research

method and thematic analysis. Data collection and analysis is a mixed and continuous process obliging us to reflect throughout qualitative research. Theme analysis method is used in data analysis. This research has been done via open coding, axial coding and selective coding.

### Findings

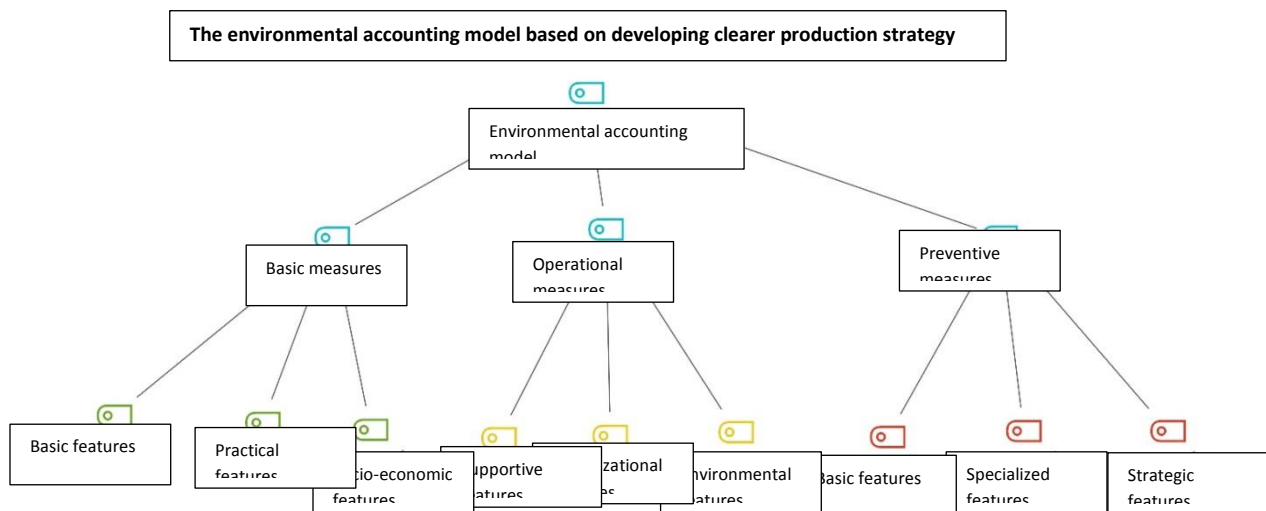
As mentioned, among the approaches presented in the grounded theory, the systematic approach has been used in this study. In this approach, data have been collected and analyzed by performing three stages of open, axial, and selective coding from the grounded theory. By performing open coding, the data has been opened so that all the possible cases can be observed. The data collected based on this analytical model was analyzed in several steps. First, 15 people were classified based on the three stages of clean production strategy development using the proposed method. The main respondents were asked to identify the development of their organization's clean production strategy using the instruments in the researches done by Jabbour & Santos (2006) and Jabbour et al. (2010). Based on the study of Gunarathne, N., Lee, (2020), respondents' classifications were evaluated with interviews and other secondary data resources to measure consistency and validity. The final

determination of the development level of each company's clean production strategy was agreed by all respondents.

### Extracted codes of the environmental management model with the aim of developing a cleaner production strategy

According to the findings, among the 15 interview files, 1 code was extracted for presenting the environmental model, 3 main codes were extracted for the description of basic, preventive and operational measures. Then, sub-codes were extracted for each of them. A total of 73 sub-codes and a total of 77 were extracted from the interviews performed for the given model, and the frequency distribution and frequency percentage of all of them are shown below. In addition, the total frequency of the codes in all 15 interview files is 1053. Also, in the table below, the coverage of the codes corresponding to each of the 15 interview files are reported as a percentage for each of the extracted codes.

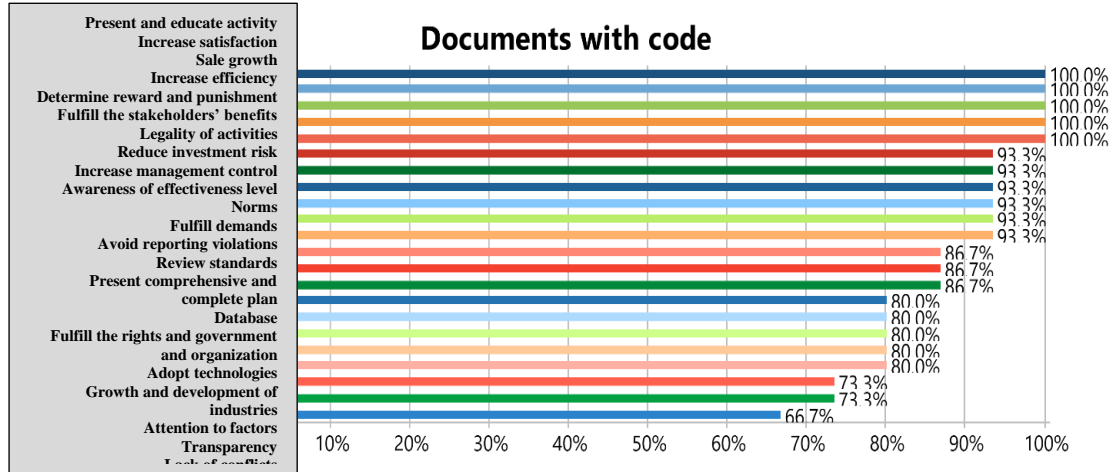
Chart 2 shows that the highest percentage of the frequency of the components of basic measures referred in all the interviews is in the first rank: provide and educate activities, increase satisfaction, increase sales, increase productivity and determine punishments and rewards.



Source: Research findings

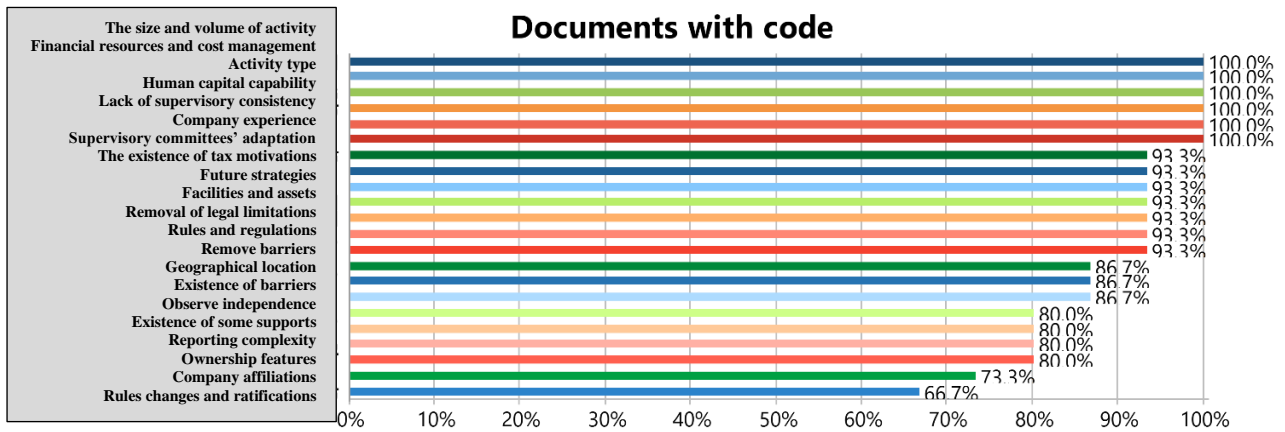
Chart 1. Optimal research model based on main-codes and sub- codes

Chart 2. Frequency percentage of the components of basic measures



Source: Research findings

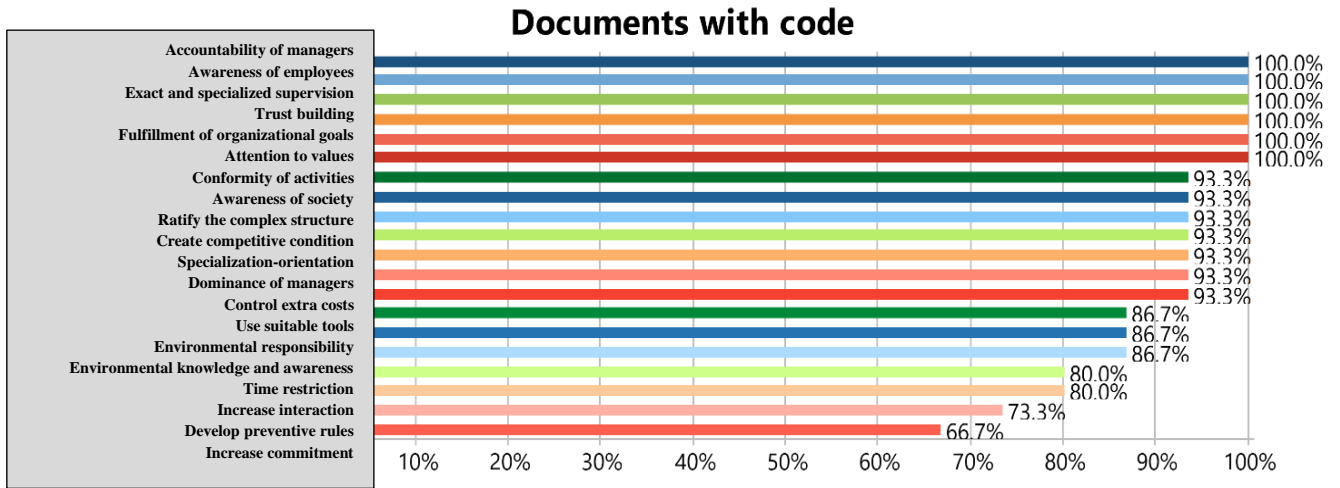
Chart 3. Frequency percentage of components of operational measures



Source: Research findings

Chart 3 shows that the highest percentage of operational measures components mentioned in all the interviews which are in the first rank are: size and volume of activity, financial resources and cost management, activity type, capability of human capital, lack of regulatory fit, lack of accountability.

Chart 4. Frequency percentage of components of preventive measures



Source: Research findings

Chart 4 shows that the most frequent components of preventive measures mentioned in all the interviews, with the first rank include: managers' accountability, employees' awareness, exact and specialized supervision, trust building, fulfillment of organizational goals, attention to values.

Chart 5. Tree Chart of operational measures

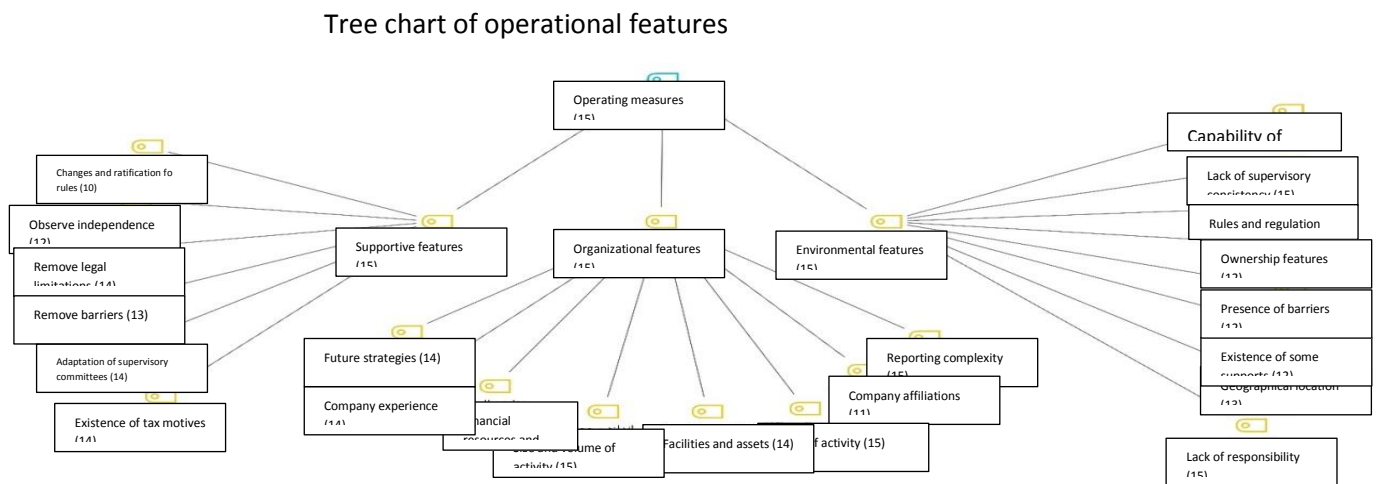




Chart 6. Tree Chart of basic measures

نمودار درختی اقدامات بنیادی

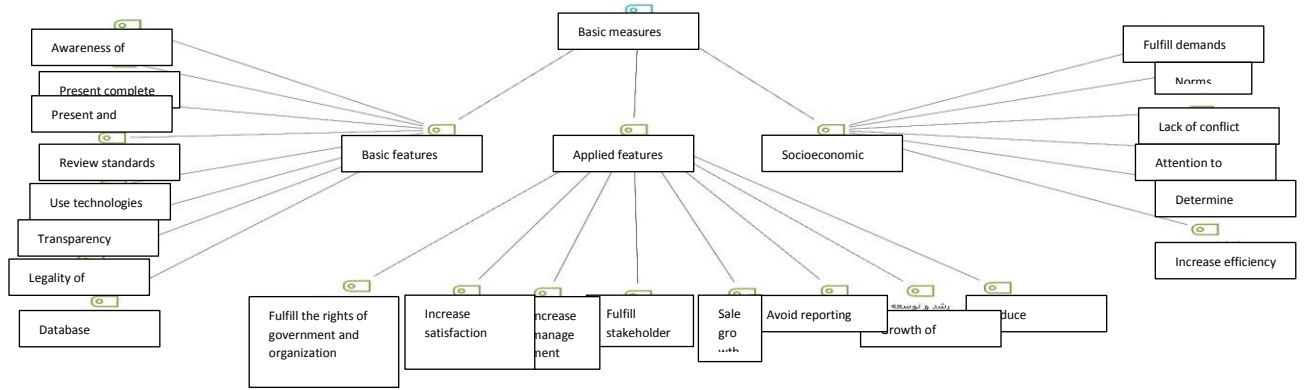
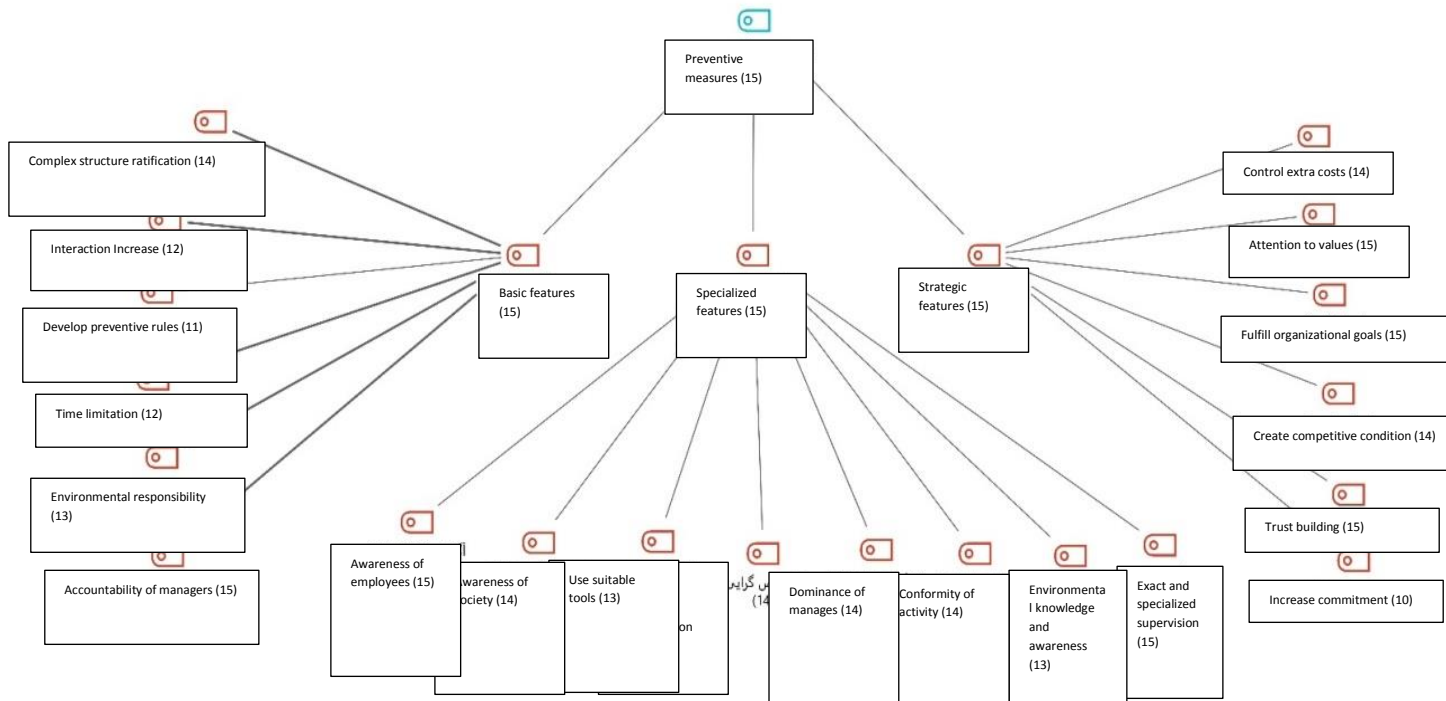


Chart 7. Tree Chart of preventive measures

Tree chart of operational features



Semi-structured interviews were conducted with at least two parties from each organization, one from the environment-based function and the other from the accounting function as recommended by Voss et al. (2002). A combination of accounting and experts from

other sectors is necessary to develop a comprehensive account of EMA in an organization, as previous studies present EMA as a transdisciplinary commitment (Bartolomeo et al., 2000: 32 and Christ and Burritt, 2013: 165)

**Figure 1. Functions of environmental management accounting model with the aim of strategy development**

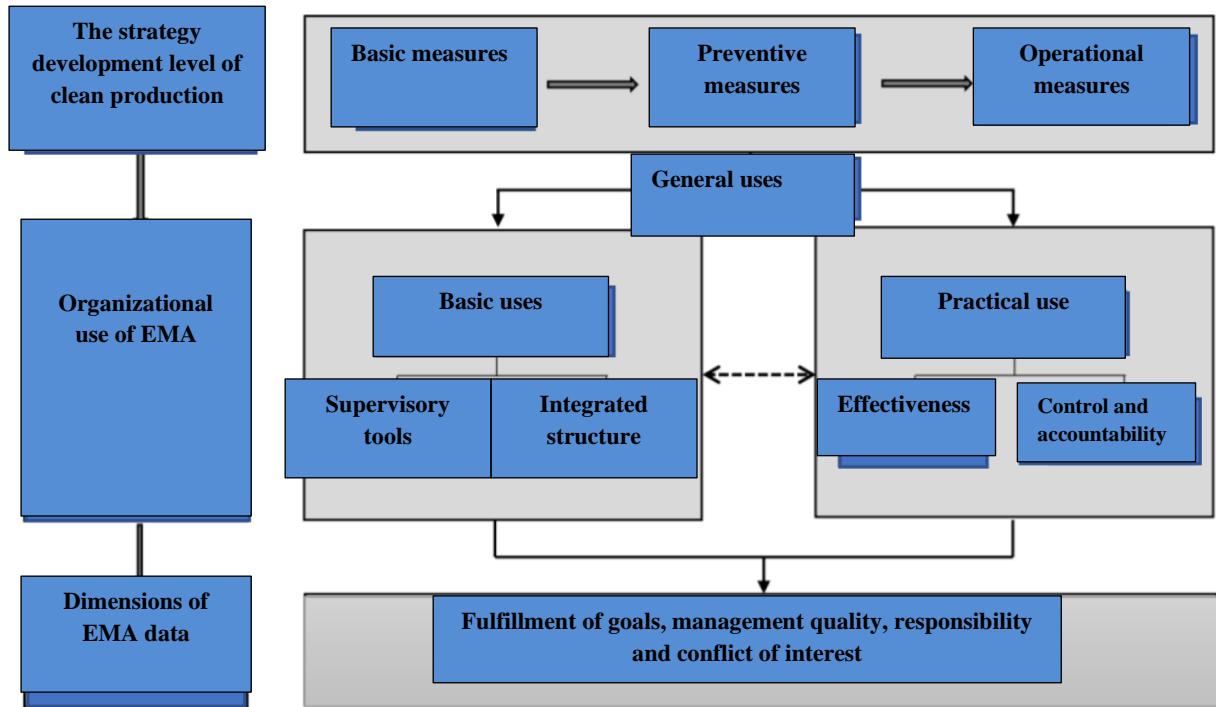
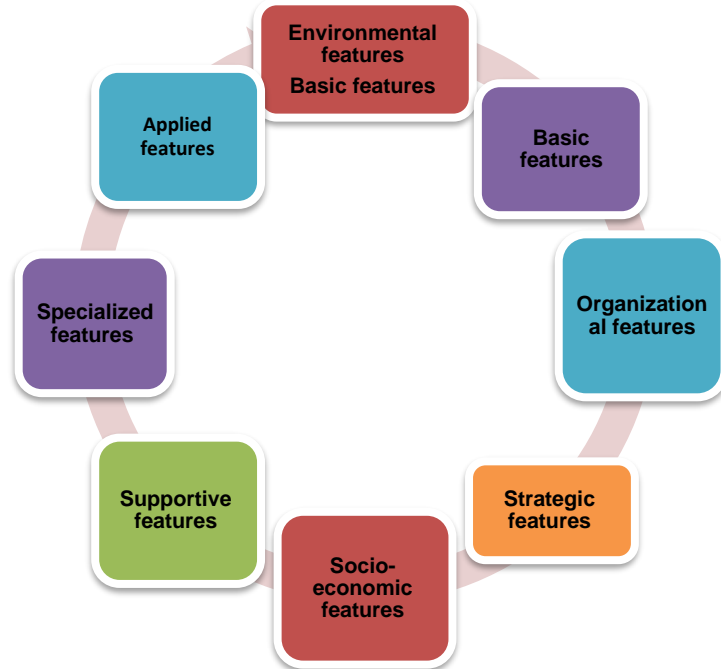


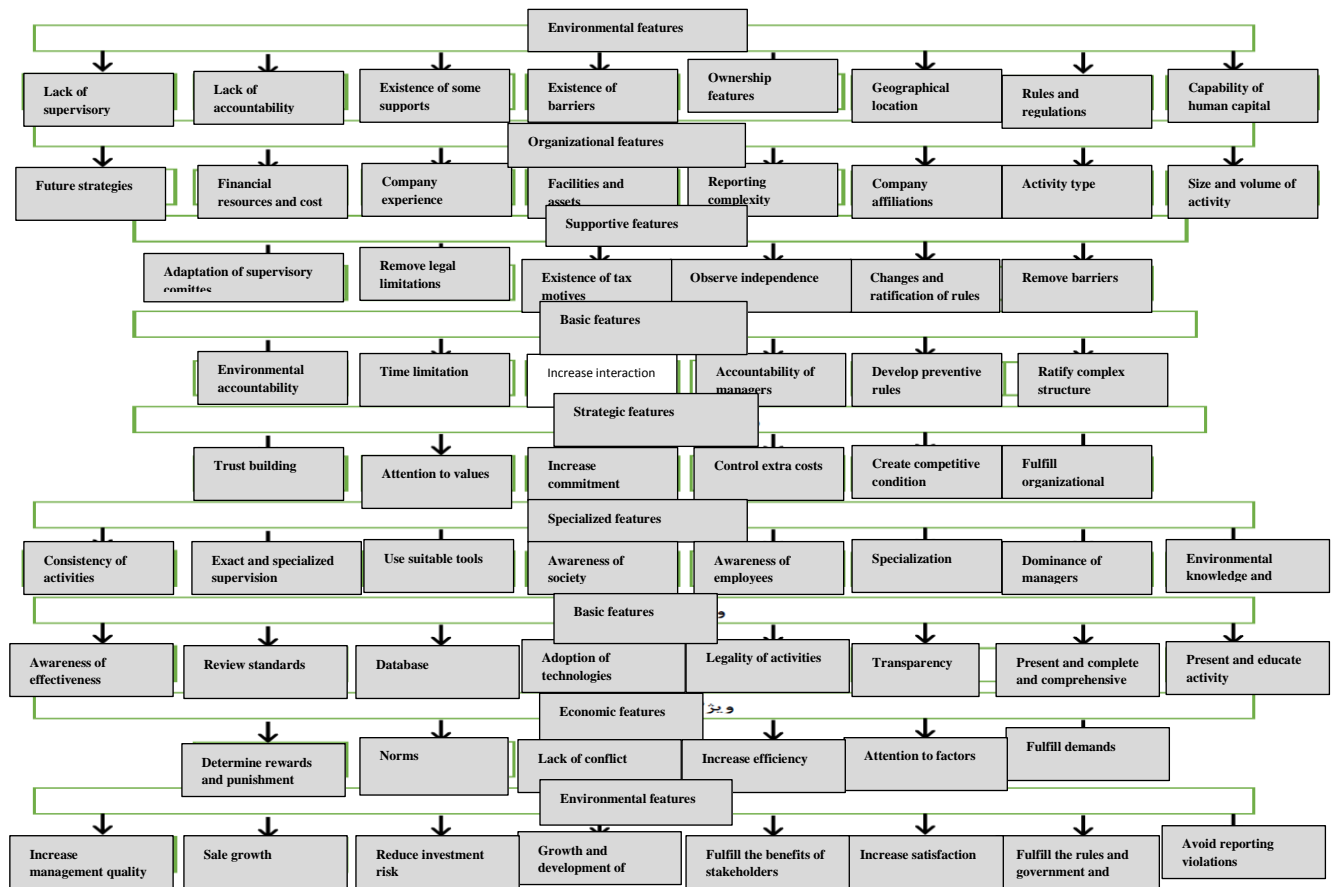
Figure 1 shows that organizations at three different levels of clean production strategy development (basic, preventive and operational stages) can show two different uses of EMA: a) basic applications (by

creating an integrated structure and monitoring tools), and b) practical uses (for control and accountability, and effectiveness).

**Chart8 . The main categories of environmental management accounting model with the aim of strategy development**



**Chart 9. The components of the environmental management accounting model of with the aim of strategy development**



**Conclusion**

Everything existing around us is called environment. Companies play an important role in the environment destruction due to inappropriate exploitation of natural resources. Meanwhile, the principle of natural resources conservation and promoting environmental norms is a social duty. Thus, the environment and its protection is a significant debate since the beginning of human social life. Today, with the competition intensification in production, trade and the promotion of local and national levels to international levels, and considering the modern needs of human society, as well as the existence of issues and problems such as environmental pollution, energy crisis, the problem of eliminating industrial waste, etc., the need to pay attention environmental protection is considered as one of the essential conditions for the sustainability of growth and development programs. As mentioned, environmental management accounting as the link between management accounting and the company's

environmental strategies, is among the effective factors on observing environmental issues, which leads to cleaner production used by companies and plays a crucial informational role in the company's sustainable development.

This study sought to identify how EMA uses differ among organizations at different levels of cleaner production strategy development. Overall, the study found that EMA uses are limited and fragmented in organizations at the initial stages of cleaner production strategy development with the exception of using EMA for cost savings and efficiency improvements. However, the high level of use of EMA for decisions on cost and efficiency improvements is mainly driven by accounting for energy and materials. The study also found that even in the organizations at the advanced levels of cleaner production strategy development, the use of EMA is mainly focused on control and stewardship functions with some limited uses for a variety of decision-making purposes such as pricing,

CVP analysis and short-term oriented decisions. However, in general, the study finds that as and when organizations mature in their environmental management activities, there is a relatively high level of use of EMA in terms of integrative tools and control and stewardship purposes.

In this research, an environmental management accounting model was developed with the aim of developing a cleaner production strategy. Based on the findings of the research, 9 main categories and 64 sub-components were identified. The findings indicated that environmental management accounting is based on economic and environmental concepts, and its use, based on not using market-based values, requires a change in culture. Environmental management accounting can present reporting complexities and a wide part of its necessity in society via partial changes in existing laws and enforcement. Also, by providing more fundamental knowledge and participation in daily work activities, it contributes to determine the goal of continuous development as a specific approach, and it is possible to increase environmental responsibility through some norms and avoid negative environmental consequences. Considering the problem of environmental accounting is an attitude that enables us to pay more attention to the environment conservation importance and using optimal methods and rational use of resources and preserving and maintaining the environment. This issue can lead to economic achievements such as cost management, resource management, sustainable development, etc. Also, in such an environment, managers are not only responsible for the efficiency of operations, but also should be responsible for the environmental and social effects of their activities and clearly recognize the importance and consequences of the environmental effects of their activities, because managers play a crucial role in organizing policies and directing the environmental effects, so they can achieve this goal by employing expert managers. Some companies may focus not on general methods of environmental management accounting, such as energy, materials, etc., , as these companies are supported by a few or are aware of the weakness of the laws, and this is realized through careful monitoring and modification of existing laws of environment protection. However, the exact monitoring and compliance of environmental management accounting standards depends on the industry and the relevant certification standard, and

some contradictions may be caused by the mismatch between the nature of the company's activity and the relevant rules. Integrated tools, control and monitoring objectives

Generally the results of this research are indicating that the uses of environmental management accounting in the initial stages of development of cleaner production strategy would lead to cost saving and the improvement of the companies' efficiency; in fact, the high level of using environmental management accounting for the purpose of decision makings about the improvement of the cost management and organization, would have a significant efficiency. Moreover, based on the results or findings of the research it might be argued that the use of environmental management accounting generally would have an outstanding role on the supervisory and accountability functions, and can play a prominent role in line with the integrated tools, and controlling and monitoring objectives.

Burritt and Schaltegger (2010) and Gunarathne & Lee (2021) showed that the conformity of accounting components and standards is among the effective factors on environmental compliance and clean production. Also, Ferreira et al. (2010) and Christ and Burritt (2013) showed that the industry type is one of the determining factors of environmental management accounting procedures. Burritt et al. (2002) revealed that legal requirements and permits are among the determinants of environmental management accounting methods. Gunarathne & Lee (2021) showed that cost management, control and monitoring are among the key indicators determining the environmental management accounting procedures. Lee (2012), Schaltegger and Csutora (2012) and Gunarathne & Lee (2021) showed that environmental characteristics, accounting and reporting information, accounting procedures, complexity and diversity of activity are among the criteria that determine environmental management accounting. Burritt and Schaltegger (2010) indicated that among the most important operational applications and accounting features, environmental management improves effectiveness and cost management, reduces excessive cost, and develops efficient investment and economic growth. Gunarathne & Lee (2015) revealed that environmental management accounting mitigates the complexity of reporting and increases the quality of management and decision making.

Consequent to these findings, a number of avenues for future research can be suggested. First, an opportunity exists for a more in depth exploration of how the other individual contingent variables such as environmental sensitivity of the industry, organizational life cycle, environmental uncertainty, and competitive strategy affect the uses of EMA by extending the analytical framework developed in the study. Second, in light of the results of this study, which suggest that organizations irrespective of their level of cleaner production strategy development have limited uses of integrative EMA tools, and EMA for decision-making purposes, it will be valuable to identify the factors that contribute towards this profoundly. Third, it will also be interesting to identify how the EMA implementation can either support or inhibit the development of corporate cleaner production strategy by way of a longitudinal analysis.

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