



International Journal of Environment and Sustainable Development

ISSN online: 1478-7466 - ISSN print: 1474-6778

<https://www.inderscience.com/ijesd>

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DOI: [10.1504/IJESD.2021.10041190](https://doi.org/10.1504/IJESD.2021.10041190)

Article History:

Received: 22 December 2020

Accepted: 31 May 2021

Published online: 05 December 2022

From cleaner production to sustainability: multiple case studies in Uruguayan companies

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Abstract: Since the concept of cleaner production (CP) considers not only the environment but also the economic and social dimension, additional scholarly attention is focused on studying the relationship of CP to sustainability. This research aims to present the main elements that contribute to successful CP implementation and sustainability in organisations. Eleven companies, mostly SMEs that adopted CP practices after a training course, were selected from different industrial sectors. The main results showed that the critical success factors most often cited for achieving successful implementation are commitment from top management and government support. Although some companies continue to implement sustainable practices, the majority apply CP only to comply with environmental laws, which results in a limited contribution to sustainability. Additionally, the analysed companies do not have standardised metrics to evaluate their sustainable performance, but CP serves as

a guide to support their decisions. More effort is needed to make companies aware of the benefits of CP in other areas of organisations, and to integrate the three domains of sustainability when implementing CP practices.

Keywords: cleaner production; critical success factors; CSFs; sustainability; Uruguay; SMEs.

Reference to this paper should be made as follows: Kalemkerian, F., Lamela, S., Santos, J. and Tanco, M. (2023) 'From cleaner production to sustainability: multiple case studies in Uruguayan companies', *Int. J. Environment and Sustainable Development*, Vol. 22, No. 1, pp.77–94.

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1 Introduction

According to United Nations Environmental Program (UNEP) cleaner production (CP) is defined as “the continuous application of an integrated preventive environmental strategy to products, processes and services to increase eco-efficiency and reduce risks to humans and the environment”. Regarding products, CP pursues decreasing the negative impacts across the life cycle, beginning from the raw material extraction to final disposal. It entails integrating environmental considerations into designing and delivering services. In manufacturing process, CP entails conserving raw materials while replacing hazardous ones, reducing the amount and toxicity of all emissions and wastes, and conserving energy (UNEP DTIE/InWEnt, 2004). Therefore, CP is a tool and a methodology that

allows companies to identify where and why they are losing resources in the form of waste and contaminants and how these losses can be reduced.

By implementing CP company leaders can evaluate different strategies to reduce the negative environmental and human health impacts caused by industry operations, therefore, accelerate the sustainable transition (Almeida et al., 2015). Over the last two decades CP has been one of the most implemented environmental management strategies among organisations (Gunarathne and Lee, 2019), aided by the considerable efforts of United Nations Industrial Organization (UNIDO), UNEP, and several other agencies to promote CP implementation.

Although there is evidence of the positive correlation between CP and improved company performance (Hart and Dowell, 2011), the incorporation of sustainable strategies still represents a great challenge for companies. Khalili et al. (2015) identified a gap between the short-term, microeconomic focused CP strategies and macroeconomic sustainability. For these authors sustainable development requires long-term horizons and the creation of a new perception, policies, methodologies and procedures, highlighting the importance of the development of human capital required to make the transition. While literature has shown evidence that the economic, environmental, and social results obtained by the implementation of CP in many industrial sectors are increasingly inseparable, there is no direct evidence of study on the benefits of CP for sustainability (Matos et al., 2018). One of the difficulties found by the authors is the absence of an environmentally friendly culture, which hampered seeing the benefits of CP. For developing nations, CP programs still face barriers and have not been largely implemented (Vieira and Amaral, 2017). In this context, in Latin America and the Caribbean, the low demand for sustainable strategies, as well as the small availability of experts to support these strategies, impede the transition to sustainability (Ashton et al., 2017).

However, several organisations have been promoting the implementation of CP. The UNEP joined forces with UNIDO to develop cleaner production centres (CPCs) in developing and transition countries, providing proper training and education. Therefore, CPCs play an important role in encouraging the implementation of preventive environmental strategies by governments and industrial sectors in emerging countries (UNEP, 2006). In 2010, UNEP and UNIDO created the resource efficient and cleaner production programme net (RECPnet) in order to assist organisations in these issues. There are over 70 providers of RECP services on a global level in developing and transition countries (RECPnet, 2016).

Considering the Uruguayan context, the implementation of CP has been widely promoted in the country, with financial help from governmental institutions and multilateral agreements with private organisations. In particular, the centre for cleaner production (CCP) led by the University of Montevideo promotes the implementation of eco-efficient production practices in companies. Since 2005, the CCP has prepared several managers from 60 different companies for the implementation of CP practices. In general, most of the companies that have taken part in the CCP are SMEs. These companies make a significant contribution to the economies on a national and global scale since they constitute more than 95% of all organisations and represent almost 65% of total employment. There are between 420 million and 510 million SMEs worldwide, with 310 million in emerging markets (ITC, 2019). The adoption of CP principles and practices has a positive impact on SMEs since the changes implemented in their production systems can guide them towards sustainable transitions (Oliveira Neto et al.,

2017). However, the implementation of CP is low in small organisations, due to limited resources, lack of leadership and owners' concentrated decision-making (Rolim Nunes et al., 2019).

Based on the above, this research aims to present the key factors for the successful implementation of CP and analyse their contribution to developing new sustainability strategies for organisations. To this end, 11 Uruguayan companies that have successfully adopted the CP methodology proposed by the CCP were selected.

This paper is organised into six sections. The next section reviews the literature on CP implementation and its impact on sustainable development. Section 3 presents the methodology followed in the study and the main findings are presented in Section 4. Section 5 presents a discussion of the research results, and the last section is the conclusions.

2 Literature review

This section outlines the main critical success factors (CSFs) for CP implementation and its impact on sustainability, considering different industrial sectors. For this purpose, the WoS database was used to capture relevant literature.

2.1 CSFs for CP implementation

CSF are characteristics, conditions or variables whether properly maintained or controlled adequately, have a positive impact on a company's success (Leidecker and Bruno, 1984). A study carried out by Vieira and Amaral (2017) showed that the main CSF for CP dissemination involve organisation characteristics related to culture, strategic planning and resources. Dissemination of knowledge, the existence of CP leaders, the use of environmental accounting and environmental reports, integration between company sectors, stakeholder commitment, and change in regulatory focus are some of the strategies identified to overcome the barriers during CP implementation (Vieira and Amaral, 2016). It is considered that having ISO 14001 certification (Vieira and Amaral, 2017) promotes an environmentally friendly culture and contributes to a systematic allocation of resources, positioning the companies in a more advantageous situation when implementing CP programs (De Oliveira et al., 2016). A study conducted by Fadly (2020) at SMEs in Vietnam indicated that companies with certifications have saved resources by reducing the use of electricity, fuel and water. Matos et al. (2018) found that internal, organisational, external, and social pressures based on a culture that considers the problems of sustainability and the environment are key. Some authors highlighted the need for cooperation among external stakeholders such as governments, industrial sectors and organisations to incentive the implementation of CP (Almeida et al., 2015; Vieira and Amaral, 2017). In line with these findings, Augusto de Oliveira et al. (2019) cited institutional pressures (regulatory, normative, suppliers, and economic), highlighting that supplier pressure is more relevant than regulatory or economic pressures in industrial organisations for the widespread adoption of CP. Some Chinese companies enhanced their environmental awareness due to external pressures from government which implies regulatory, competitive and marketing controls (D'Souza et al., 2020).

SMEs in particular face several limitations that may affect the course of their sustainability transitions. These include lack of financial incentives, lack of management

time, resistance to change and lack of policies (Oliveira Neto et al., 2017). Nunes et al. (2019) proposed a methodology focused on overcoming internal barriers for SMEs during CP implementation. Their methodology is based on a meta-phase, which involves promoting and monitoring and a five-step cyclic phase: standardise and plan, analyse flow, generate preventive opportunities, get approval, and implement CP improvement. This methodology allowed companies to develop products and processes that helped organisations meet their sustainability objectives more efficiently. Oliveira Neto et al. (2017) proposed a framework, which consists of four basic steps: first, identify the barriers; second, prioritise and identify the causes and effects; third, perform economic and environmental analysis of the effects, and, finally, analyse the opportunities to overcome the barriers identified.

Furthermore, it is important to highlight that the extent, depth and complexity of CP strategies may change according to development stage of the environmental management activity of an organisation (Gunarathne and Lee, 2019). Every environmental management maturity level promotes companies to seek solutions that can make environmental initiatives economically possible and lead to the minimisation of external and internal environmentally-related risks (Moutchnik, 2015).

2.2 Impact of CP on sustainability

The 2030 Sustainable Development Agenda recognises the inseparability of the three domains of sustainable development: social, economic, and environmental (de Alba and Todorov, 2020). According to the report of the United Nations World Commission on Environment and Development, Sustainable Development (henceforth, SD) implies “a process of change, in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations” (Kiss, 1988). The transition to SD involves higher levels of energy efficiency, transportation, and waste management, together with a gradual change in consumer behaviour and involvement followed by an increase in the use of renewable energies (Almeida et al., 2017).

For about 20 years, the definition of CP remained essentially the same (Hens et al., 2018). While the environmental aspect was the central focus, gradually more attention has been given to resource efficiency, to the social dimension of sustainability (support for the development of people and communities) and to the economic dimension (enhanced production efficiency, business profitability, and competitiveness while reducing costs). Therefore, several authors have studied the role of CP on sustainability. A wide variety of CP strategies lead to sustainability not only through effective resource management and energy utilisation, but also through the implementation of innovative and smart technology, new ways of assisting policy development, and the organisation of supply chains, markets, and companies (Giannetti et al., 2020). Asha'ari and Daud (2019) highlighted that CP and resource efficiency, which involve the use of green technology, constitute one of the most important green practices for the incorporation of sustainability performance. Additionally, reduced environmental pollution and improved efficiency of energy utilisation can also be achieved through CP practices (Wang et al., 2015). In line with these findings, Severo et al. (2015) found that organisations can reduce their environmental impact by implementing environmental practices such as CP. There is also evidence of the positive influence of implementing CP practices with other sustainable

strategies such as lean manufacturing and circular economy. With regards to lean manufacturing, the main findings revealed that companies that follow the lean philosophy adopt more CP practices and have better environmental performance (Ramos et al., 2018). Research results from Sousa-Zomer et al. (2018) showed that CP initiatives regarding product optimisation are key for the incorporation of circular economy principles at the micro level for product design strategies.

Some authors highlighted that for industries CP constitutes a fundamental mechanism for sustainable development (Ashton et al., 2017; Wang et al., 2015) which encompass the idea of economic improvement through the three dimensions of sustainability (Utama, 2018). Several studies addressed the implementation of CP practices in order to achieve a broader scope of sustainability in a wide range of industrial activities. Examples include the pulp and paper sector (Susilawati and Kanowski, 2020), the textile industry (de Oliveira Neto et al., 2019a; Tayyab et al., 2020b); the mining industry (Moehr-Swart et al., 2009); the chemical (Asha'ari and Daud, 2019) and petrochemical industry (Vukadinovic et al., 2018; Bai et al., 2019); manufacturing companies (Ramos et al., 2018); the metal-mechanical sector (Severo et al., 2015); and beyond industry, in agricultural activities (Hai et al., 2016; Chopin et al., 2016; Chowdhury and Moore, 2017). Table 1 summarises the main results of the impact on sustainability of implementing CP.

A study carried out in the metal-mechanical sector showed that the implementation of CP practices influenced both environmental sustainability and organisational performance by increasing the capacity of production and its flexibility, and enhancing employees health and safety (Severo et al., 2015). In the case of the textile industry, results showed how the economic and environmental improvements resulting from CP directly contribute to the SDGs (Sustainable Development Goals) nine (industry, innovation and infrastructure), 12 (responsible consumption and production) and 15 (life on land) (de Oliveira Neto et al., 2019b). The main results showed that CP promotes innovation by ensuring sustainable production patterns. Similar results were found by Giannetti et al. (2020) which concluded that CP contributes to SDG 12 and 9. Additionally, it promotes the sustainable utilisation of existing ecosystems by reducing basic raw materials, electricity consumption, and industrial waste generation by using modern equipment and technology innovation. Similar studies in the sector showed that investments in wastewater treatment reduce the quantity of effluent water by 12.56% and variable CO₂ emissions cost by 20.98% per batch, highlighting that these initiatives promote economic growth and reduce environmental impacts (Tayyab et al., 2020a). In the petrochemical industry the implementation of CP practices leads to a decrease in total energy consumption by 6% and in greenhouse gas emissions by 9 t CO₂e (Vukadinovic et al., 2018). In the case of power plant enterprises, Wang et al. (2015) highlight that CP has the potential to increase the level of SD.

There are three main sustainability strategies to implement CP: efficiency, which focuses on improving economic value and at the same time decreasing negative environmental impacts; consistency, which seeks to substitute toxic materials and energy flows with more environmentally friendly ones (Schaltegger et al., 2008); and sufficiency, which seeks to eliminate products or services that do not add value. In this context, the use of relevant information plays a key role for appropriate planning, implementation and control of the mentioned strategies (Gunarathne and Lee, 2019).

It is important to mention that there is no single suitable method to incorporate CP initiatives in sustainability strategies and each initiative can impact on different ways to

achieving a broader scope of SD (Almeida et al., 2015a). The authors also point out that proper sustainability policies, objectives, strategies and clear reports of results are necessary responsibilities that main external forces (governments, academia and industrial sectors) and organisations should assume in order to move towards SD. While there are still few publications which specifically address the extent to which the SDGs are pursued by the various CP activities and practices, CP is widely regarded as a method for achieving SD (Giannetti et al., 2020).

Table 1 Impact of CP on sustainability

<i>Paper</i>	<i>Industrial sector</i>	<i>SD domain</i>	<i>Description</i>
Moehr-Swart et al. (2009)	Mine	Environmental and economic	Cost water and energy savings
Wang et al. (2015)	Power plants	Environmental	Energy efficiency
Severo et al. (2015)	Metal-mechanical	Environmental and social	Production capacity and flexibility health and safety
Hai et al. (2016)	Agriculture	Environmental and Economic	Cost and waste
Vukadinovic et al. (2018)	Petrochemical	Environmental	Energy efficiency and emissions
Asha'ari and Daud (2019)	Chemical	Environmental	Resource efficiency
de Oliveira Neto et al. (2019a)	Textil	Economic and Environmental	SDG 9, 12, 15
Bai et al. (2019)	Mine	Environmental	Resource use
Tayyab et al. (2020b)	Textile	Environmental	Resource use and emissions

As seen in Table 1, the majority of the articles which address the contribution of CP to SD are focused on the environmental dimension in particular by analysing the management of resources.

3 Methodology

As stated before, this paper aims to study the impact of CP on sustainability with a focus on the environmental domain in different industrial sectors by analysing the implementation of CP and presenting its key success factors. To achieve this, the following research questions are presented:

RQ1 What elements are key to achieving successful implementation of CP in SMEs?

RQ2 How does CP contribute to developing new strategies towards environmental sustainability?

To answer to these questions, a semi-structured interview technique was used since it is considered as an appropriate technique for collecting data in qualitative analysis (Bryman, 2003). An aide-memoire was prepared to guide the interviewer during the conversations. This guide was prepared based on the main findings of Nunes et al. (2019), Vieira and Amaral (2017) and Oliveira Neto et al. (2017). After an interview with the CP leader of each company, a plant tour was conducted.

3.1 Selection of cases

One of the main activities organised by the CCP is a training course with a theoretical-practical perspective where the companies implement the CP methodology and identify opportunities for improvement in their production process. In order to develop future strategies for the CCP, a survey was sent to the companies that took the course. The results revealed that most of the companies adopted at least one of the CP actions identified during the course, almost 70% of the companies surveyed continue to apply CP practices and only 40 % continues to monitor economic and environmental key performance indicators (KPIs). To conduct this research, the companies that continue to monitor indicators and implemented the CP methodology were selected. Considering these criteria, 11 companies accepted to participate in this research.

The companies were classified into small and medium sized enterprises, based on number of employees. Although the focus of this study is on SMEs, some large companies were also included in the results section. Table 2 presents a characterisation of the SMEs.

Table 2 Characterisation of the companies

<i>Company</i>	<i>Number of employees</i>	<i>Size</i>	<i>Products or services</i>	<i>Certifications</i>
A	17	Small	Sponges	No
B	130	Medium	Chemical industry	ISO 9001, ISO 14001, ISO 45001
C	65	Medium	Malt production	ISO 9001
D	130	Medium	Plastics	ISO 14001, ISO 9001 (in process)
E	78	Medium	Wool	No
F	50	Small	Transportation	ISO 9001
G	200	Medium	Steel	ISO 14001, ISO 9001, ISO 18001, ISO 50001 (in process)
H	40	Small	Wool	No
I	27	Small	Coffee	No

4 Results

This section presents the key factors to successful CP implementation and a characterisation of the companies regarding the CP contribution to developing sustainability strategies according to each CP leader's perception.

Firstly, the external key success factors identified are presented. Most companies have a clear understanding that having an environmental legal framework is essential to promote environmentally conscious practices in the companies. This legal framework may impose certain restrictions that require companies to improve their production practices in order to meet the proposed standards. In addition, government initiatives and financial support constituted a driver for CP programmes, especially in company E, which took the CP training course with financial support from governmental institutions. Company F reinforces this idea since government initiatives (economic incentives,

recognitions, funding) to reduce electricity consumption in the country help them focus on improving this area. Additionally, for company H, the implementation of the CP opportunities in the area of energy efficiency was positively influenced by the government initiatives mentioned above.

For company C, the legal environmental standards of its European clients played a key role because the company was forced to adapt its production practices to client requirements.

Company D's participation in different government promoted programmes and the association with external institutions are key elements to maintaining sustainable practices. In this context, the CP leader from company A mentioned that cooperation between companies and the different agents of the supply chain is crucial during implementation but more effort is needed to improve the synergy between different organisations.

As for internal factors, the most commonly cited factor was support from top management. Company G emphasised that the commitment of top management and how they integrate the methodology of CP in the company is essential for allocating the proper human and financial resources needed to implement the practices identified by the methodology. Companies B, D and F stated that the existing company culture allowed them to develop the opportunities suggested by the methodology with no resistance from the employees. Therefore, organisational culture constitutes a decisive factor during implementation. Company F also mentioned that the organisation's alignment with environmental issues facilitates the implementation of CP concepts and practices.

Findings also revealed that proper training and education were key to raising awareness, especially if the CP opportunities involve changes in the production practices. This idea was mentioned by company C, whose project involves the reutilisation of malt. Therefore, they had to engage their employees in different activities and make them aware of the benefits that these new practices bring to the company. The CP leader from companies E and I mentioned that training and education are necessary not only among the company employees but also in society, where cultural change is needed to promote more environmentally conscious practices.

Having an environmental department in charge of monitoring environmental KPIs and which supports the CP leader also constitutes a key factor. In particular, companies D and G mentioned that monthly meetings with a KPI report helps them evaluate the performance of each area of the company. In addition, it keeps the organisations updated since it is a way to benchmark with other companies that make up the business group. In line with this idea, the incorporation of new monitoring technology plays an important role in collecting data from the indicators because it allows companies to take actions and establish new objectives to improve their performance. This idea was mentioned by company H, which needs to have their KPIs continuously monitored. For company F, the new technology developed for the truck fleet helps to improve their economic and environmental performance in their operations.

Additionally, the commitment of the CP leader was a key factor to encourage the rest of the employees during the implementation process. For company I, the CCP tutors also played an important role since they helped identify CP opportunities and guided the CP leaders during the execution of the projects. For company B, the vast experience of the CCP industry instructor was important for implementation.

Finally, Table 3 summarises the key factors for successful CP implementation based on interviews with the CP leaders of the selected companies. These factors do not claim

to be exhaustive. As shown in the table, the commitment of top management and CP leaders, and government support are the most often cited factors.

Besides the key success factors, the interviews revealed that the analysed companies have reached different environmental management maturity levels.

Table 3 Key success factors for CP implementation

Company	Key success factors							
	External				Internal			
	Government support	Market pressure	Cooperation in the supply chain	Commitment of top management	Organisational culture	Training	Monitoring KPIs	Existence of CP leaders
A			x	x				x
B				x	x			
C		x				x		
D	x		x	x	x		x	x
E	x					x		
F				x	x			
G	x			x			x	x
H	x						x	
I				x		x		

As shown in Table 3, most of the companies have neither environmental certifications nor people designated to deal with sustainability issues. Therefore, they face several barriers when trying to implement sustainable practices. Although these companies monitor and control KPIs, most of them are focus on production performance. Therefore, the implementation of CP was considered an isolated practice conducted by the production department and in some cases without the commitment of top management. Additionally, these companies consider only an economic criterion when discussing whether to implement a new practice or not, making it difficult to promote sustainability in the organisations.

On the other hand, the companies that have reached higher environmental management maturity levels are continuously looking for ways to adopt more sustainable practices. In particular, companies D and G have environmental departments to control and monitor KPIs and are ISO 14001 certified, providing them a framework to incorporate sustainability strategies. The top management at these companies is committed to adopting new practices for reducing the environmental impact of their operations. After implementing CP, companies D and G have adopted other sustainable practices related to circular economy strategies and lean manufacturing. Although they control and monitor KPIs, they are associated with environmental and economic aspects considered independently. These KPIs generally focus on water consumption, energy and raw materials, and when the economic domain is assessed only costs are considered. Therefore, there is no standardise metric to evaluate their sustainable performance.

Subsequently, the interviews indicated that most of the CP leaders perceive CP strategies as a way to improve operational performance. Therefore, they did not find a direct relationship between CP strategies and a long-term vision of sustainable development regardless of the company's environmental management maturity level. In other words, the interviewees do not consider that CP contributes to developing new strategies that can guide companies towards sustainability in their business environment. As they see it, the CP methodology provides the company with a useful tool and framework to assess the economic and environmental impact of incorporating a new practice.

Although the interviews were focused on small companies, two large companies were also interviewed: a sawmill and a meat processing plant. The factors mentioned by both companies were aligned with those stated by the SMEs.

The CP leader of the sawmill said that since organisations must comply with the legal environmental standards of their European clients, they eliminated the plastic protection in their product presentation to meet a European client's requirement. The CP leader from the other company highlighted compliance with environmental standards but also mentioned that in some cases, particularly when related to food safety, the requirements of its clients have a negative impact on environmental factors, forcing the company not to be as environmentally conscious as they would like.

Another idea discussed was that because of the vast amount of rumen handled in the meat processing industry, proper training and education constituted key factors in raising awareness on the proper disposal of the rumen. The manager of the sawmill mentioned that sharing experiences with the CCP instructors was essential for successful implementation. Both are large companies which have environmental departments and control and monitor KPIs.

5 Discussion

5.1 CSFs for CP implementation

Firstly, the study identified the key factors, both internal and external, of successful CP implementation as presented in Table 3. The two most commonly cited internal factors were the existing organisational culture and support from top management. This result is consistent with the literature, since top management is responsible for making the necessary organisational changes for sustainability incorporation (Gunarathe and Lee, 2019). Moreover, when implementation involved changes in production practices, employee training and education acted as another success factor. These findings are in line with Vieira and Amaral (2016), who identified cultural changes and dissemination of knowledge as key strategies to overcome the barriers faced during CP implementation.

The continuous monitoring of KPIs and regular meetings are also considered internal factors, both of which make it possible to detect new opportunities for improvement and which are positively influenced by the incorporation of new technology. The results showed that the existence of CP leaders in the organisation and integration between different areas of the companies are considered key factors during the implementation (Vieira and Amaral, 2016).

On the other hand, government support with new laws and financial help to promote CP in companies is identified as an external factor. The interviewees also mentioned that

client pressure, particularly for companies that work with European clients, constitutes an enabler to improve their environmental performance. It is worth highlighting the importance of market pressures to achieve improvements in the design of products and manufacturing processes but institutional pressures are also important for companies to adopt CP practices (Augusto de Oliveira et al., 2019). Furthermore, collaboration in the supply chain is mentioned as a key factor for achieving success and at the same time is a way to continue improving implementation. Adopting CP requires a change in the behaviour of all actors involved in the implementation process (de Oliveira Santos et al., 2020).

Some of the enablers/key factors identified for CP implementation mentioned above are, at the same time, enablers of sustainable manufacturing, in particular, government promotion and regulations (Moktadir et al., 2018; Bhanot et al., 2017; Elmualim et al., 2012), pressure from market and education (Bhanot et al., 2017); and leadership and commitment from top management (Siemieniuch et al., 2015; Elmualim et al., 2012). This may imply that the companies that have implemented CP should concentrate their efforts in pursuing the enablers that also support them in the transition towards sustainability.

Key to sustaining and improving CP implementation is employee involvement, which facilitates the speed of continuous improvement (Rolim Nunes et al., 2019). Similar findings were observed by Garcia-Sabater et al. (2012) in the implementation of continuous improvement activities, where the use of incentive systems is key to employee participation. For companies that have adopted lean manufacturing practices, the idea of continuous improvement prompts them to think constantly about how to enhance their performance. This way they can identify new opportunities for improvement and sustain the improvements already in place. In line with this, some authors evidence the positive synergies between the introduction lean practices and improving environmental performance (Leme et al., 2018; Alves Pinto Junior and Mendes, 2017). Furthermore, the control and monitoring of environmental KPIs is essential for continuous improvement. Setting more challenging objectives and the need for metrics were identified by Garcia-sabater et al. (2012) as enablers for continuous improvement. The correct implementation of a system of metrics and learning from the results obtained are also important elements. Furthermore, some companies said that the incorporation of a management system that facilitates continuous improvement is essential.

Due to the diversity of industrial segments of the selected companies, the key factors mentioned above are not presented in the same way among the different companies because each industrial sector has its own regulations and principles. Some differences presented in this paper are between small, medium and large companies. For small companies the dissemination of knowledge within the organisations was easier than in the large companies, since the size enabled the CP leaders to inform all the employees of the new practices adopted. This knowledge sharing is mentioned by Jurburg et al. (2017) as an important factor for promoting employee intention to participate in continuous improvement activities. However, small companies must face several barriers related to the lack resources (financial and economic), and the lack of infrastructure. The low priority given to environmental issues by management is also identified as a frequent barrier in SMEs (Oliveira Neto et al., 2017). In these cases, support from government institutions plays an important role if companies want to continue to develop the methodology. This support not only implies funding but also provide recognition and

guidance for those companies that improve their performance by adopting eco-efficient practices. On the other hand, most of the medium and large companies have environmental departments (especially the ones with ISO 14001 certification) that support the CP leader and which have an existing culture of commitment to environmental issues, thus making the process of the implementation more dynamic. Additionally, ISO 14001 provides them with a framework for implementing CP practices. These results are in line with De Oliveira et al. (2016), who concluded that organisations that are ISO 14001 EMS certified are more prompt to adopt CP practices and, as a result, manage their business in a more environmentally proactive way.

5.2 CP contribution to sustainability

Our analysis reveals that the organisations associate the concept of CP with efficiency strategies which focus on limiting the consumption of raw materials, water and energy at the origin of the process and at the same time reducing operating costs (Henriques and Catarino, 2015; Schaltegger et al., 2008). Similar findings in companies in Sri Lanka were discussed by Gunarathne and Lee (2019) by analysing how environmental and managerial information support CP to achieve a broader scope of sustainability. In this context, the companies with environmental departments and environmental certifications continue to develop new strategies towards more sustainable modes of production even though there is a lack of methodologies to achieve a broader scope of sustainability. Although having environmental departments supports the CP leader during implementation, greater integration between the different departments in the organisation is needed for sustainability incorporation (Almeida et al., 2015). Additionally, the companies that present monthly KPI reports (in general focused on resource consumption, number of accidents and economic KPIs) discuss new strategies to improve their performance. Therefore, the use of information plays a key role in designing long-term strategies which focus on corporate environmental sustainability (Gunarathne and Lee, 2019).

On the other hand, companies generally implement CP solely to comply with legal requirements or certifications since these companies are small and have neither environmental departments nor certifications. Similar results were found in SMEs in Venezuela, where the eco-efficient practices adopted by the companies aim at reducing costs or avoiding sanctions (Fernandez-Vine et al., 2010). Therefore, these companies make only a limited CP contribution to the realisation of the Sustainable Development Goals (Gunarathne and Lee, 2019), allocating limited resources (financial resources, human capital or infrastructure) to improve their sustainable performance. The companies with small profit margins that have to pay special attention to their economic situation see the changes proposed by CP implementation as an opportunity for significant financial savings while improving their environmental performance, but not as a way to achieve a broader scope of sustainability. This result can suggest that these companies are not motivated to develop new strategies focused on sustainability due to the great challenge that it represents for them.

Despite the differences among the companies selected, the main results revealed that from the companies' perspective CP does not directly contribute to the development of company's long-term sustainability strategies. In some cases, the CP implementation was limited to the economic and environmental domains, thus highlighting the need to incorporate the three dimensions of sustainability during CP training and implementation.

The social dimension was not widely discussed by the CP leaders only some of them mentioned that the implementation of some practices impact positively on the health and safety of their workers by reducing the number of accidents.

Additionally, it is worth mentioning that those organisations, which have adopted the CP methodology continue to make use of the framework proposed for analysing the impact of adopting changes in their production practices. This result suggests that the adoption of CP helps to overcome the lack of models used to measure the impact of the changes in the transition towards sustainability (de Jesus Pacheco et al., 2019). Idea which is also reinforced by Matos et al. (2018) since the CP methodology can be the correct path to follow by organisations that seek to improve their sustainability performance. This may imply that, based on the CP methodology, companies with government, academicians and other external forces must work altogether to find more standardised methods to evaluate their sustainable performance and to motivate them to introduce more sustainable modes of production.

6 Conclusions

This research sought to identify how companies that have adopted CP manage their transitions towards sustainability and what the main factors are to achieving successful implementation.

In order to answer the first research question proposed (RQ1), some of the key factors that help companies to achieve successful CP implementation were discussed. Commitment by the companies that conducted the implementation, not only from the CP leaders but also the top management, were the success factors most often cited by the interviewed companies. This may imply that proper training and education in these areas is essential for top management to guide their organisations towards more sustainable modes of production. The main findings reveal that CP provides the companies with a framework to analyse the economic and environmental impact when they consider making changes in their production practices. Therefore, it constitutes a powerful tool to guide companies to adopt more sustainable modes of production. However, despite the differences in the environmental management maturity levels of the selected companies, the CP methodology was not considered by the interviewees to have a direct contribution to sustainability (RQ2). This result may be attributed mainly to the lack of knowledge and awareness about SD concepts and the limited vision of CP, since in general the social domain is underrepresented when discussing the CP contribution to SD.

Finally, this study has some limitations. The results obtained cannot be generalised as the study was carried out in a limited number of Uruguayan organisations. Indeed, the utilisation of case studies is a limitation when a broader degree of generalisation is required.

Expanding the research to a greater number of companies, and using a more structured and statistically validated research strategy is recommended for future work. Additionally, based on the CP methodology, more standardised metrics are needed to evaluate the sustainable performance of the companies. Therefore, further research should consider this approach to develop standardised metrics to guide companies, especially SMEs during their sustainable transition.

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