International Business Research; Vol. 16, No. 7; 2023
ISSN 1913-9004 E-ISSN 1913-9012
Published by Canadian Center of Science and Education

Exploring the Relationship Between Circular Economy Practices and Growth in Manufacturing SMEs

Gonzalo Maldonado-Guzmán[1], Raymundo Juárez-del Toro[2] & Víctor Manuel Molina-Morejón[2]

[1] Departamento de Mercadotecnia, Centro de Ciencias Económicas y Administrativas, Universidad Autónoma de Aguascalientes, Aguascalientes, México

[2] Facultad de Contaduría y Administración, Universidad Autónoma de Coahuila Unidad Torreón, Torreón, Coahuila, México

Correspondence: Gonzalo Maldonado-Guzmán, Departamento de Mercadotecnia, Centro de Ciencias Económicas y Administrativas, Universidad Autónoma de Aguascalientes, Aguascalientes, México., Avenida Universidad No. 940, Ciudad Universitaria, C.P. 20131, Aguascalientes, México.

Received: May 23, 2023 Accepted: June 23, 2023 Online Published: June 26, 2023

doi:10.5539/ibr.v16n7p74 URL: https://doi.org/10.5539/ibr.v16n7p74

Abstract

The circular economy has been acknowledged as key for manufacturing firms, wishing overcome challenges, particularly relates it to business growth. However, the transition to linear economy at circular economy has been slow in literature, particularly there are relatively few studies that have focused on the relationship of circular economy practices and growth of small and medium-sized manufacturing companies, for this reason this study's main objective is to fill this existing gap in the literature. In addition, a self-administered questionnaire was distributed to a sample of 400 companies in the automotive and auto parts industry in Mexico, analyzing the data set using confirmatory factor analysis and structural equation models. The results obtained follow that the circular economy has a significant positive impact on the growth level of small manufacturing firms in the automotive and autoparts industries.

Keywords: Circular economy, growth, small and medium-sized enterprises

1. Introduction

The circular economy (CE) concept was introduced in the literature in 1980s when the first article analyzing this construct was published, and since then it has received significant attention from researchers, academics, and industry professionals (Lieder & Rashid, 2016). Likewise, the existing literature offers a diversity of CE definitions, most of them agreeing that the concept practically refers to the harmonization between the firm's economic growth and environment protection (Bassi & Dias, 2019). In addition, the most used definitions of CE consider the 3Rs: *reduction*, *reuse*, and *recycling*, since these three elements describe more accurately the fundamental activities carried out in CE implementation in manufacturing firms (Liu *et al*., 2017).

In this sense, the most CE definition used in the literature is the established by Ellen MacArthur Foundation (2015), who includes in its definition the economic and environmental advantages of CE, considering that CE can be conceptualized as *"an industrial economy that is totally reconstituted or regenerative with the intention of designing products with part of reuse or recycling"* (EMF, 2015: 52). Furthermore, a substantial element in this definition is the difference between linear economy and CE, in which it is established that linear economy is perceived as the end of product life cycle that becomes a waste, while CE is considered as a resource that influences sustainable development, and, recently, on economy business growth (Bassi & Dias, 2019).

However, the implementation of different circular economy practices (CEP) in manufacturing firms of all sizes and sectors, it is generally considered as an investment that does not generate any economic benefit (Dalhammar, 2016), for which public administration required to develop policies that not only favor CEP, but also inform the benefits that this entails (Bassi & Dias, 2019). Likewise, researchers, academics, and industry professionals have recognized that CEP generate different environmental and economic benefits for organizations and automotive industry companies, since a higher level of small firm's growth (Vargas-Hernández & López-Lemus, 2021), and higher market development (Dalhammar, 2016).

Additionally, scientific, academic, and professional community has been recognized that lifestyle, consumption,

and production is vital for sustainable development improvement, so that consumers must support CEP to consume products that eco-friendly to environment (Bassi & Dias, 2019). As a result of the above, various studies have focused on the analysis and discussion of CEP in manufacturing firms in different parts of the world such as United Kingdom (McDonald & Oates, 2003), Switzerland (Jansson *et al.*, 2010), Finland and Netherlands (Repo *et al.*, 2018), Japan (Hanyu *et al.*, 2000), and China (Huang *et al.*, 2006), in different industrial sectors such as automotive sector (Ge & Jackson, 2014), and in different areas such as in Scandinavian countries (Dalhammar, 2016).

Likewise, CEP have commonly been oriented in large companies, leaving aside their analysis and discussion in small and medium-sized enterprises (SMEs) (Ormazabal *et al*., 2018), even though this firms represent around 95% of the total companies in OECD member countries (OECD, 2017), generate between 40 and 45% of the total industrial pollution and water and energy consumption (Ormazabal *et al*., 2018). Therefore, it is possible to establish that CEP in SMEs can be considered as inconclusive (Rizos *et al.*, 2016; Ormazabal *et al*., 2018; Bassi & Dias, 2019). Thus, this study contributes to CE literature with new knowledge generation, in addition to also complementing other papers published in the current literature (Ormazabal *et al*., 2018; Bassi & Dias, 2019; Vargas-Hernández & López-Lemus, 2021).

For this reason, when the relationship between CEP and SMEs manufacturing growth is considered inconclusive in the literature, this study tries to expand and complement knowledge and provide robust empirical evidence that allows establishing the following research question: *What is the relationship between circular economy practices and SMEs manufacturing growth in the automotive industry?* The rest of the study has been structured as follows: in the second section the literature review is presented, and the research hypothesis is established; in the third section the methodology used is set; The fourth section includes the analysis and interpretation of the results and finally, in the fifth section the conclusions, limitations and future studies are noted.

2. Literature Review

In the literature it is clearly established various environmental, economic, and social consequences that generate natural resources depletion, which is generating an essential change in consumers, organizations and public administration that requires better environment and sustainability protection (Ormazabal *et al*., 2018). However, most manufacturing firms around the world are implemented an out-of-date linear economic system, which practically consists in "do it, take it, use it and throw it away" (Ormazabal *et al*., 2018). In contrast, CE emerges as *"an economic system that represents a paradigm shift in society and is totally interrelated with nature by establishing the prevention of the depletion of natural resources, the proper use of energy, materials and raw materials which facilitates sustainable development"* (Prieto-Sandoval *et al*., 2018: 607).

Furthermore, nations such as Germany, France, United Kingdom, Japan and China have made substantial progress in the adoption and implementation of policies that facilitate and promote CEP use (Blomsma & Brenan, 2017; Murray *et al*., 2017), such as the Action Plan implemented by European Community (European Commission, 2016), which is one of the main drivers of CEP adoption and implementation among various manufacturing firms in European Union countries, each one setting specific goals and their scope (Gordeeva, 2017). This Action Plan establishes that products must be redesigned by manufacturing firms to facilitate their repair, maintenance, recycling, remanufacturing, and incorporation many recycled materials as possible (Hughes, 2017).

Likewise, SMEs are the group of companies that have the greatest influence on the process of CEP adoption and implementation through the Action Plan, since they represent around 99% of the total of existing firms in European Union (Filipe *et al.*, 2016). However, it is not strange to find in the scientific literature that various researchers, academics and professionals in the industry have demonstrated and provided evidence of the effects that SMEs have on sustainable development, since 70% of global SMEs generate around 45% of the total polluting emissions of the industries, and around 40% of the consumption of water and energy of the total of the countries that make up European Union (Ormazabal *et al*., 2018), which shows the importance of the adoption of CEP in SMEs manufacturing firms.

Recent studies published in the literature highlight the various benefits and opportunities of implementing CEPs in manufacturing firms (e.g., Kumar *et al.*, 2019; Aloini *et al.*, 2020), but a high percentage of SMEs manufacturing firms around the world, they do not have a clear knowledge of the advantages offered by the application of CEP (Jaeger & Upadhyay, 2020), nor the experience in this context (Fobbe & Hilletofth, 2023). To enable a generalized transition from the flow of linear to circular resources in organizations, SMEs manufacturing firms play an essential role, derived from the impact on the global economy, society, and sustainable development that these types of companies have (Blomsma *et al.*, 2019; Jaeger & Upadhyay, 2020; Bjornbet *et al.*, 2021). However, despite the high growing promotion od CEP by scientific, academy, and social community, less than 9% of the

world economy is circular (Circle Economy, 2020).

In this context, CEP allows to regenerate the economic system of the companies in which the input of materials and energy and the output of waste and CO_2 are minimized, while it allows an economy growth of the companies (Geissdoerfer *et al.*, 2017; Kirchherr *et al.*, 2017). Therefore, CEP is generally recognized as a key approach for sustainable development of manufacturing SMEs (Ellen MacArthur Foundation, 2022). Finally, products should be returned to manufacturing SMEs such as materials and energy (Park *et al*., 2010; Ellen MacArthur Foundation, 2013), generating the least amount of waste, which is presented in two ways possible: biological wastes that are returned to the biosphere, and technical wastes that are generally returned to industries as part of their processes (McDonough & Braungart, 2002).

In this sense, manufacturing SMEs play an essential role in CEP implementation, since they represent the largest percentage of firms participating in the market (Ormazabal *et al*., 2016). Likewise, SMEs are too heterogeneous and generally do not have the same level of development and maturity of sustainable development (Ormazabal & Puga-Leal, 2016), so the application of diverse CEP have different effects on their growth level. However, most of the manufacturing SMEs were established under a linear economy process, therefore, to make the change to a circular economy process, they require progressive stages to improve their sustainability level, but it is also true that there are SMEs in which it is possible to implement CEP from one day to the next (Ormazabal *et al*., 2018).

Therefore, to support SMEs to improve sustainable development management level, Ormazabal *et al.* (2015) proposed a maturity environmental management model maturation, which allow manufacturing SMEs to be more reactive in their maturation stage, in such a way that they significantly improve their proactivity level in CEP implementation. However, manufacturing SMEs are generally more reactive than proactive in environmental issues due to the economic costs they represent, in addition to not perceiving a significant relationship between various environmental practices and the SMEs profitability and growth (Biondi *et al*., 2002).

Thus, CEP should be aligned not only with environmental practices, but also provide a higher level of economic growth for manufacturing SMEs, so that they are able to *"create, capture and deliver value by creating more a value that allows SMEs to improve the efficiency of resources, thereby contributing to the extension of the life cycle of products (redesign, repair and remanufacturing) and raw materials"* (Nubholz, 2017: 15). Therefore, efficiency in environmental management may improve CEP in manufacturing SMEs, through the recycling and remanufacturing of their products (Geyer & Jackson, 2004; Zhang *et al*., 2011; Ongondo *et al*., 2013), offering rental services instead of their sale (Bakker *et al*., 2014), and dismantling (Ehrenfeld, 2000; Yang *et al*., 2014), which could generate a higher growth level in manufacturing SMEs.

In this same order of ideas, if manufacturing SMEs properly apply CEP, they could possibly be able to increase environmental practices collaboration with other SMEs (Ormazabal *et al*., 2018). In this sense, Biondi *et al*. (2002) and Daddi and Iraldo (2015) provided empirical evidence showing that manufacturing SMEs can acquire various competitive advantages, if they work collaboratively with other companies in the same sector or in another industry, since they can create an industrial symbiosis that facilitate the recycling and reuse of raw materials, making their different production processes generate not only more environmentally friendly products, but also a greater profit margin and business growth (Ormazabal *et al*., 2018).

Likewise, industrial symbiosis represents an essential element in CEP implementation in manufacturing SMEs, because it is considered as *"the activity that involves traditionally separate companies in a collective approach to obtain competitive advantages through exchange physical of materials, energy, water and/or products"* (Chertow, 2000: 315). However, studies published in the literature have shown that CEP implementation in manufacturing SMEs generates numerous barriers that they have to avoid (e.g. Ormazabal *et al*., 2016; Rizos *et al*., 2016; Ritzen & Sandström, 2017; Nubholz, 2017), but there are also other studies that establish various opportunities for manufacturing SMEs to reduce uncertainty in CEP implementation (e.g. del Río *et al*., 2016; Ormazabal & Puga-Leal, 2016; Rizos *et al*., 2016).

Under this perspective, CEP implementation in manufacturing SMEs, can represent an opportunity for firm to generate various innovations that contribute to natural environment regeneration through the improvement of their environmental actions (Carrillo-Hermosilla *et al*., 2010). In this sense, Ellen MacArthur Foundation (2015: 51) considered that CEP implementation in firms in the mobility, automotive, food and construction sectors can help improve environment, because *"CO_2 emissions will have to be reduced by 48% by 2030 and 83% by 2050, compared to 2012 emission levels, in addition to the consumption of raw materials per vehicle, the use of synthetic fertilizers, pesticides, water use, non-renewable oils and energy have to be reduced by 32% by 2030 and by 53% by 2050"*.

Thus, CEP represent an opportunity to improve sustainable development of manufacturing SMEs, as well as

achieving new markets that allow them to obtain a higher business growth level (Moore & Manring, 2009). Consequently, these opportunities can generate various advantages: SMEs may have the opportunity to open new markets (Porter & Van der Linde, 1995; Moore & Manring, 2009), consumers can purchase products with a higher quality level (Zanoli & Naspetti, 2002; Bougherara & Combris, 2009), and the creation of more sustainable products that can improve both eco-innovation cycles development and SMEs growth level (Hofstra & Huisingh, 2014; Prieto-Sandoval *et al*., 2016). Therefore, considering the information presented above, it is possible to pose the following research hypothesis.

H1: The circular economy practices have a significant positive influence on SMEs level growth.

3. Methodology

3.1 Research Design

Theoretical representation was the criterion used to identify manufacturing SMEs in the automotive industry operating in Mexico. A four-stage filter was used to identify the organizations to participate in this study. Firstly, we screened for manufacturing SMEs that participated in automotive industry supply chain. Secondly, we identify manufacturing SMEs that had associated their production with the main stakeholders of the vehicle assembly companies, at the same time, aiming to be economic growth successful. Thirdly, we selected SMEs that were transitioning from a linear economy to a circular economy in their production processes, and as a result, contributed toa reduction in environmental waste. Fourthly, AMIA (Mexican Automotive Industry Association) executives who supported the study with data from the board of SMEs and, of course, the organization's directives to participate in this study.

Considering the statistical equation proposed by Murray and Larry (2005), and to reduce the sampling error to have a higher quality of data, in this study calculate the probabilistic sample size with 95% confidentiality and a maximum error of 5%, obtaining a sample of 460 companies. To demonstrate that desired statistical power of sample is met, they were calculated through GPower, whereby sample size N is computed as a function of power level $1 - \beta$, significance level α, and the to-be-detected population effect size, obtaining a sample of 460 firm.

3.2 Data Collection

As a primary method of data collection, 10 semi-structured interviews were conducted with three researchers from innovation area and seven entrepreneurs from the automotive industry, who can provide information regarding aspects of CEP approach. Before the interviews, we conducted, a questionnaire design was established to increase study reliability and validity, and questionnaire were tested to ten entrepreneurs of automotive industry for understandability, duration and to clarify potential ambiguities. These types of studies are essential for validation when applying self-administered questionnaires or when using previously validated scales (Bryman, 2016; Hair *et al*., 2016).

The questionnaire was applied to a sample of 460 small firms selected through simple random sampling, with a maximum error of ±4% and 95% reliability level, applying during the months of January to March 2019. At the beginning of the questionnaire applied, the respondents were briefed on the purpose of the study and guaranteed anonymity. The questionnaire had two parts. On one hand, focused on the growth level of manufacturing SME in the last two years. On other hand, focused on manufacturing SME engagement related to CEP implementation efforts. The transcriptions were sent to the 460 questionnaires to check for potential errors in SPSS software, thus enduring reliability and internal validity of the measurement scales used (Hair *et al.*, 2016).

Furthermore, for CEP measurement, an adaptation was made to the scale proposed by Zhu *et al*. (2010), who considered that CEP can be measured through 3 factors: *internal environmental management* measured through 10 items; *eco-design* measured by 4 items and *investment recovery* measured through 5 items. Regarding the growth level measurement, this was measured through the sales made by SMEs in 2018 (Autio & Lumme, 1998; Ballow *et al*., 2004; Salojärvi *et al*., 2005; Linder, 2006; Carneiro, 2007; Kruger & Johnson, 2009), since in order to estimate the growth potential that SMEs may have, a manager's qualitative evaluation is generally considered, with sales being, the main indicator for their measurement (Autio & Lumme, 1998). Likewise, a five-point Likert-type scale was used to measure all the items on CEP scale with 1 = total disagreement and 5 = total agreement as limits, since this scale provides a balance between the interviewee's complexity and the information analysis (Forza, 2016; Hair *et al.*, 2016).

3.3 Data Analysis

The data were analyzed in a multistep process following the guidelines from Bentler (2005), Brown (2006) and Byrne (2006). EQS 6.2 software was used to facilitate the process and ensure analytical rigor (Bentler, 2005; Brown, 2006; Byrne, 2006). The data were analyzed, in the first phase, through Confirmatory Factor Analysis

(CFA) using the maximum likelihood method, to measure reliability and validity and, in the second phase, through Structural Equation Modelling (SEM), to test the research hypothesis. Cronbach ś Alpha and Composite Reliability Index (CRI) were used to measure reliability (Bagozzi & Yi, 1988), and Extracted Variance Index (EVI) were used to measure validity (Fornell & Larcker, 1981).

CFA results are presented in Table 1 and show that Cronbach ś Alpha and CRI values are greater than 0.70 value proposed by Nunally and Bersntein (1994) and Hair *et al.* (2014), and EVI values are greater than 0.50 value proposed by Fornell and Larcker (1981). As evidence of the convergent validity, CFA results indicate that all the items of the related factors are significant ($p < 0.01$), the size of all the standardized factor loads are greater than 0.60 (Bagozzi & Yi, 1988). Finally, data analysis provides empirical evidence of the reliability and validity of the measurement scales used in this study, and justifies its internal reliability (Nunally & Bersntein, 1994; Hair *et al*., 2014).

Table 1. Reliability and validity of the theoretical model

Variable	Indicator	Factorial Loading	Robust t-Value	Cronbach's Alpha	CRI	EVI
Internal Environmental Management (F1)	IE1	0.819***	1.000[a]	0.940	0.941	0.615
	IE2	0.835***	21.465			
	IE3	0.868***	22.804			
	IE4	0.844***	21.830			
	IE5	0.799***	20.100			
	IE6	0.799***	20.099			
	IE7	0.769***	19.045			
	IE8	0.719***	17.363			
	IE9	0.672***	15.876			
	IE10	0.691***	16.473			
Eco-design (F2)	ED1	0.720***	1.000[a]	0.913	0.914	0.728
	ED2	0.850***	18.059			
	ED3	0.954***	19.980			
	ED4	0.872***	18.534			
Investment Recovery (F3)	IR1	0.915***	1.000[a]	0.936	0.937	0.750
	IR2	0.948***	36.014			
	IR3	0.858***	27.724			
	IR4	0.801***	23.855			
	IR5	0.799***	23.762			
Circular Economy Practices	F1	0.826***	7.211	0.857	0.858	0.675
	F2	0.641***	5.860			
	F3	0.965***	8.448			
$S\text{-}BX^2$ (df = 146) = 996.639; p < 0.000; NFI = 0.837; NNFI = 0.832; CFI = 0.856; RMSEA = 0.079						

[a] = Constrained parameters to such value in the identification process

*** = $p < 0.01$

4. Results

Normalized Fit Index (NFI), Non-Normalized Fit Index (NNFI), Comparative Fit Index (IFI) and square root of the mean of the approximation error (RMSEA) were considered in SEM analysis (Bentler & Bonnet, 1980; Byrne, 1989; Bentler, 1990; Hair *et al.*, 2014; Chau, 1997; Heck, 1998). Segars and Grover (1993) considered that NFI, NNFI and CFI have an average value from 0.80 to 0.89, it is considered that there is a reasonable adjustment of the theoretical model. Conversely, if the average of these indices is equal or above 0.90, then there is evidence of an excellent adjustment of the theoretical model (Jöreskog & Sörbom, 1986; Byrne, 1989; Papke-Shields *et al.*, 2002), and when the value of RMSEA is below 0.080, it is considered acceptable (Jöreskog & Sörbom, 1986, Hair *et al.*, 2014).

Results show that the measurement model has a good fit of statistical data analysis ($S\text{-}B\ X^2$ = 996.639; df = 146; p = 0.000; NFI = 0.837; NNFI = 0.832; CFI = 0.856; RMSEA = 0.079) and provide empirical evidence that shows that CEP has a significant positive relationship with the growth level of manufacturing SMEs. Table 2 shows in greater detail the results obtained from the application of SEM.

Table 2. Results of SEM

Hypothesis	Structural Relationship	Standardized Coefficient	Robust t-Value
H_1: Circular economy practices have a positive influence in SMEs growth level.	C.E.P. → Growth	0.997***	33.956
$S\text{-}BX^2$ (df = 146) = 996.639; p < 0.000; NFI = 0.837; NNFI = 0.832; CFI = 0.856; RMSEA = 0.079			

*** = P < 0.01

Table 2 shows the results obtained from SEM application and, with respect to the hypothesis **H**1, the results obtained $\beta = 0.997\ p < 0.001$, indicate that CEP have a positive effect in business growth in manufacturing SMEs in the automotive industry. In conclusion, it can be corroborated the existence of a strong relationship between CEP and business growth of manufacturing SMEs, which allows us to conclude that CEP is an excellent predictor of manufacturing SMEs growth.

The results obtained in this study support our argument that CEP has a positive effect on business growth of manufacturing SMEs, these results being consistent with those by Ormazabal *et al*. (2018), Bassi and Dias (2019), and Vargas-Hernández and López-Lemus (2021). The main reasons that could explain this positive effect are, on one hand, the clarity that manufacturing SMEs directives have of various benefits generated by the implementation of CEP in the organizations, not only in sustainable development issues, but also in economic growth issues. On other hand, the strong pressure that manufacturing SMEs directives are increasingly facing form stakeholders for adoption and implementation CEP, as well as tightening of environmental standard by public administration, so that manufacturing SMEs adopt production process systems that improve environmental and sustainable development.

5. Practical Implications

The results obtained in this study have various implications for both directives and manufacturing SMEs. A first implication derived from the results obtained is that studies published in the literature have provided empirical evidence that shows the existence of internal and external factors that favor the adoption and implementation of CEP (e.g. Yadav *et al*., 2018), among which stand out the obtaining of economic benefits and the improvement of firms growth, as internal factors, and the demand for green products by the market, as an external factor (Bassi & Dias, 2019). In this sense, CEP allow manufacturing SMEs a significant reduction in waste through a system that stimulates sustainable products life cycle (Ghisellini *et al*., 2016; Despeisse *et al.*, 2017), which will allow them to close the life cycle of both materials and products refusal (Akinade & Oyedele, 2019).

A second implication is that the relationship between CEP and economic business growth has recently been gaining interest by researchers, academics, and industry professionals community (e.g. Ghisellini *et al.*, 2016; Despeisse *et al*., 2017), and it is commonly considered as a promising field of research that can be exploited for the provision of theoretical and empirical evidence that explains the diverse benefits that manufacturing SMEs adopt and implementation of CEP, including a higher level of business growth, even though there are also studies published in the literature that establish that manufacturing SMEs do not have the resources and experience to carry out sustainable activities (Cassells & Lewis, 2011).

A third implication is that CEP incorporate activities that lead to a significant reduction in materials waste in the production process of manufacturing SMEs, which implicitly allows the generation of activities that improve sustainable development (Geissdoerfer *et al*., 2017). Additionally, there are two positions in the literature on the relationship between CEP and business growth, on the one hand, who argue that both constructs are interdependent (Sauvé *et al*., 2016), while others consider that there is a significant positive relationship, since both constructs have a high correlation (Geissdoerfer *et al*., 2017), which is why this paper provides robust empirical evidence that strengthens this second position.

This study has several limitations that must be considered when interpreting the results, the first of which is related to the measurement scales of CEP and firm's growth level, since these two important constructs were measured through subjective indicators obtained through the survey application. Therefore, in future studies it will be necessary to use hard data from manufacturing SMEs (e.g., investment for internal environmental management; investment for eco-design; and investment recovery of the implementation of CEP), to verify if the results obtained differ or not from those obtained in this paper.

A second limitation of this study is that the relationship between CEP and firm's growth level, possibly generates more significant results if a moderating variable of the managers individual characteristics of manufacturing SMEs is integrated (e.g., leadership, commitment, managerial capacity, experience). Therefore, in future studies it would be pertinent to add some moderating variable that significantly improves the relationship between CEP and business growth, to corroborate if the results obtained are similar or better to those obtained in this study or replicate this same study in another sector or industry to corroborate these same results.

A third and final limitation of this study is that only three factors or dimensions were considered for CEP measurement and a single item for firms growth level measurement, which were the most cited in the literature, but no type or dimension of business growth was considered, so in future studies it will be pertinent to consider other direct measurement scales of CEP, and apply this same questionnaire in Argentina or Brazil that have similar economy and manufacturing SMEs conditions in the automotive industry, to verify if the results obtained

are similar those obtained in this study.

6. Conclusions

The results obtained in this empirical study have different conclusions. First, some of the studies published in the literature that have focused on the analysis of CEP in manufacturing SMEs have basically focused on the analysis and discussion of management of environmental practices, such as obtaining the different certifications and reduction of the use of raw materials, practically leaving aside the economic and financial effects that are general within organizations, such as the business growth level. For this reason, this study provides theoretical and empirical evidence of the relationship between CEP and firm's growth in manufacturing SMEs, especially those companies that make up the automotive industry of an emerging economy country, such as Mexico, which is the most important industry and the one that has greatest contribution to the economy development.

Second, even though it has been shown in some previously published articles that several of manufacturing SMEs managers, do not consider that CEP can generate economic benefits and an increase in market share, it is also true that there are other articles that demonstrate the opposite. Therefore, it is possible to conclude that since most manufacturing SMEs have serious limitations on their resources, a short-term vision of their organization and lack of personnel to carry out innovation activities, it is important that they implement CEP as one of its priority business activities, not only to comply with environmental regulations established by public administration, but also to achieve a higher business growth level.

Third, it is also possible to conclude the existence of essential opportunities for manufacturing SMEs to adopt and implement CEP, since they can interact with other small or large companies in the same sector to carry out collaborative activities, in such a way that they allow sharing information and resources to facilitate the transition from a linear economy to a circular economy. Therefore, in terms of CEP, it can be concluded that manufacturing SMEs in the automotive industry have more opportunities than barriers for the implementation of CEP, which can be translated into a significant increase in their business growth level.

References

Akinade, O. O., & Oyedele, L. O. (2019). Integrating construction supply chain within a circular economy: An ANFIS-based waste analytics system (A-WAS). *Journal of Cleaner Production*, *229*(1), 863-873. https://doi.org/10.1016/j.jclepro.2019.04.232

Aloni, D., Dulmin, R., Mininno, V., Stefanini, A., & Zerbino, P. (2020). Driving the transition to a circular economy model: A systematic review on drivers and critical success factors in circular economy. *Sustainability*, *12*(24), 1-14. https://doi.org/10.3390/su122410672

Auttio, E., & Lumme, A. (1998). Does the innovator role affect the perceived potential for growth? Analysis of four types of new, technology-based firms. *Technology Analysis & Strategic Management*, *10*(1), 41-54. https://doi.org/10.1080/09537329808524303

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, *16*(1), 74-94. https://doi.org/10.1007/BF02723327

Bakker, C., Wang, F., Huisman, J., & den Hollander, M. (2014). Products that go round: Exploring product life extension through design. *Journal of Cleaner Production*, *69*(1), 10-16. https://doi.org/10.1016/j.jclepro.2014.01.028

Ballow, J. J., McCarthy, B., & Molnar, M. J. (2004). *New Concepts in Value-Based Management: TRS Mapping and Total Economic Profit*. Wellesley, MA: Accenture Institute for High Performance Business.

Bassi, F., & Dias, J. G. (2019). The use of circular economy practices in SMEs across the EU. *Resources, Conservation & Recycling*, *146*(3), 523-533. https://doi.org/10.1016/j.resconrec.2019.03.019

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*(2), 238-246. https://doi.org/10.1037/0033-2909.107.2.238

Bentler, P. M. (2005). *EQS 6 Structural Equations Program Manual*. Encino, CA: Multivariate Software.

Bentler, P. M., & Bonnet, D. (1980). Significance tests and goodness of fit in analysis of covariance structures. *Psychological Bulletin*, *88*(3), 588-606. https://doi.org/10.1037/0033-2909.88.3.588

Biondi, V., Iraldo, F., & Meredith, S. (2002). Achieving sustainability through environmental innovation: The role of SMEs. *International Journal of Technological Management*, *24*(2), 612-622. https://doi.org/10.1504/IJTM.2002.003074

Bjornbet, M. M., Skaar, C., Fet, A. M., & Schulte, K. O. (2021). Circular economy in manuafcturing companies:

A review of case study literature. *Journal of Cleaner Production*, *294*(1), 1-12. https://doi.org/10.1016/j.jclepro.2021.126268

Blomsma, F., & Brenan, G. (2017). Emergence of circular economy: A new framing around prolonging resource productivity. *Journal of Industrial Ecology*, *21*(3), 603-614. https://doi.org/10.1111/jiec.12603

Blomsma, F., Pieroni, M., Kravchenko, M., Piagosso, D. C. A., Hildenbrand, J., Kristinsdottir, A. R., & McAloone, T. C. (2019). Developing a circular strategies framework for manufacturing companies to support circular economy-oriented innovation. *Journal of Cleaner Production*, *241*(12), 1-12. https://doi.org/10.1016/j.jclepro.2019.118271

Bougherara, D., & Combris, P. (2009). Eco-labelled food products: What are consumers paying for? *European Review of Agricultural Economic*, *32*(2), 321-341. https://doi.org/10.1093/erae/jbp023

Brown, T. (2006). *Confirmatory Factor Analysis for Applied Research*. New York, NY: The Guilford Press.

Bryman, A. (2016). *Social Research Methods.* 5th ed. Oxford: Oxford University Press.

Byrne, B. (2006). *Structural Equation Modeling with EQS, Basic Concepts, Applications, and Programming*. 2th edition. London: LEA Publishers.

Byrne, B. M. (1989). *A Primer of LISREL: Basic Applications and Programming for Confirmatory Factor Analysis Analytic Models*. New York, NY: Springer. https://doi.org/10.1007/978-1-4613-8885-2

Carneiro, A. (2007). What is required for growth? *Business Strategy Series*, *8*(1), 51-57. https://doi.org/10.1108/17515630710686888

Carrillo-Hermosilla, J., del Río, P., & Könnola, T. (2010). Diversity of eco-innovations: Reflections from selected case studies. *Journal of Cleaner Production*, *18*(10/11), 1073-1083. https://doi.org/10.1016/j.jclepro.2010.02.014

Cassells, S., & Lewis, K. (2011). SMEs and environmental responsibility: Do actions reflect attitudes? *Corporate Social Responsibility and Environmental Management*, *18*(3), 186-199. https://doi.org/10.1002/csr.269

Chau, P. (1997). Reexamining a model for evaluating information center success using a structural equation modeling approach. *Decision Sciences*, *28*(2), 309-334. https://doi.org/10.1111/j.1540-5915.1997.tb01313.x

Chertow, M. R. (2000). Industrial symbiosis: Literature and taxonomy. *Annual Review of Energy Environment*, *25*(1), 313-337. https://doi.org/10.1146/annurev.energy.25.1.313

Circle Economy (2020). *The circularity gap report 2020.* Retrieved from https://www.circularity-gap.world/

Daddi, T., & Iraldo, F. (2015). The effectiveness of cluster approach to improve environmental corporate performance in an industrial district of SMEs: A case study. *International Journal of Sustainability Development & World Ecology*, *23*(2), 163-173. https://doi.org/10.1080/13504509.2015.1106988

Dalhammar, C. (2016). Industry attitudes towards eco-design standards for improve resources efficiency. *Journal of Cleaner Production*, *123*(1), 186-199. https://doi.org/10.1016/j.jclepro.2015.12.035

del Río, P., Carrillo-Hermosilla, J., Könnöla, T., & Bleda, M. (2016). Resources, capabilities, and competences for eco-innovation. *Technological Economy and Development Economic*, *22*(1), 274-292. https://doi.org/10.3846/20294913.2015.1070301

Despeisse, M., Baumers, M., Brown, P., Charnley, F., Ford, S. J., Garmulewicz, A., K… Rowley, J. (2017). Unlocking value for a circular economy through 3D printing: A research agenda. *Technology Forecasting and Social Change*, *115*(2), 75-84. https://doi.org/10.1016/j.techfore.2016.09.021

EC (European Commission) (2016). *28 New Environmental Projects in the Pipeline*. Brussels: Communication from the Commission to the European Parliament, the Council of the European Economic and Social Committee and the Committee of the Regions.

Ehrenfeld, J. R. (2000). Industrial ecology: Paradigm shift or normal science? *American Behavior Science*, *44*(1), 229-244. https://doi.org/10.1177/00027640021956189

EMF (Ellen MacArthur Foundation) (2013). *Towards the Circular Economy: Opportunities for the Consumer Goods Sector (Vol. 2)*. Brussels: EMF.

EMF (Ellen MacArthur Foundation) (2015). Circular Indicators: An Approach to Measuring Circularity (Methodology). https://doi.org/10.1016(j.giq.2006.04.004

EMF (Ellen MacArthur Foundation) (2022). What is a circular economy? Retrieved June 12, 2023 from https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview

Filipe, S. F., Grammatikos, T., & Michala, D. (2016). Forecasting distress in European SME Portfolios. *Journal of Banking and Finance*, *64*(1), 112-135. https://doi.org/10.1016/j.jbankfin.2015.12.007

Fobbe, L., & Hilletofth, P. (2023). Moving toward a circular economy in manuafcturing organizations: The role of circular stakeholders engagement practices. *The International Journal of Logistics Management*, *34*(3), 674-698. https://doi.org/10.1108/IJLM-03-2022-0143

Fornell, C., & Larcker, D. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39-50. https://doi.org/10.1177/002224378101800104

Forza, C. (2016). Surveys. In: C. Karlsson (Ed.), *Research Methods for Operations Management.* 2nd Ed. New York, NY: Routledge.

Ge, X., & Jackson, J. (2014). The big data application strategy for cost reduction in automotive industry. *SAE International Journal of Commerce Vehicle*, *7*(4), 588-598. https://doi.org/10.4271/2014-01-2410

Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The circular economy: A new sustainability paradigm? *Journal of Cleaner Production*, *143*(1), 757-768. https://doi.org/10.1016/j.jclepro.2016.12.048

Geyer, R., & Jackson, T. (2004). Supply loops and their constraints: The industrial ecology of recycling and reuse. *California Management Review*, *46*(2), 55-73. https://doi.org/10.2307/41166210

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production*, *114*(1), 11-32. https://doi.org/10.1016/j.jclepro.2015.09.007

Gordeeva, Y. M. (2017). Recent developments in EU environmental policy and legislation. *Journal of European Environment Planning Law*, *14*(2), 233-241. https://doi.org/10.1163/18760104-01402007

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate Data Analysis* (7th ed.). Harlow, UK: Pearson Education. https://doi.org/10.4324/9781315704562

Hair, J. F., Celsi, M., Money, A., Samouel, P., & Page, M. (2016). *Essentials of Business Research Methods* (3rd ed.). New York, NY: Routledge.

Hanyu, K., Kishino, H., Yamashita, H., & Hayashi, C. (2000). Linkage between recycling and consumption: A case of toilet paper in Japan. *Resources, Conservation & Recycling*, *30*(1), 177-199. https://doi.org/10.1016/S0921-3449(00)00060-4

Heck, R. H. (1998), Factor analysis: exploratory and confirmatory approaches. In Marcoulides, G.A. (Ed.), *Modern Methods for Business Research*, Mahwah, NJ: Lawrence Erlbaum Associates.

Hofstra, N., & Huisingh, D. (2014). Eco-innovations characterized: A taxonomic classification of relationship between humans and nature. *Journal of Cleaner Production*, *66*(1), 459-468. https://doi.org/10.1016/j.jclepro.2013.11.036

Huang, P. S., Zhang, X. L., & Deng, X. D. (2006). Survey and analysis of public environmental awareness and performance in Ningbo, China: A case study on household electrical and electronic equipment. *Journal of Cleaner Production*, *14*(18), 1635-1643. https://doi.org/10.1016/j.jclepro.2006.02.006

Hughes, R. (2017). The EU circular economy package – life cycle thinking to life cycle law? *Procedia CIRP*, *61*(1), 10-16. https://doi.org/10.1016/j.procir.2016.12.006

Jaeger, B., & Upadhyay, A. (2020). Understanding barriers to circular economy: Cases from the manufacturing industry. *Journal of Enterprise Information Management*, *33*(4), 729-745. https://doi.org/10.1108/JEIM-02-2019-0047

Jansson, J., Marell, A., & Nordlund, A. (2010). Green consumer behavior: Determinants of curtailing and eco-innovation adoption. *Journal of Consumer Marketing*, *27*(4), 358-370. https://doi.org/10.1108/07363761011052396

Jöreskog, K. G., & Sörbom, D. (1986), *LISREL VI: Analysis of Linear Structural Relationships by Maximum Likelihood, Instrumental Variables and Square Methods*, Moorsville, IN: Scientific Software.

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114

definitions. *Resource Conservation and Recycling*, *127*(1), 221-232. https://doi.org/10.1016/j.resconrec.2017.09.005

Kruger, C. J., & Johnson, R. D. (2009). Assessment of knowledge management growth: A South Africa perspective. *Aslib Proceedings, New Information Perspectives*, *61*(6), 542-564. https://doi.org/10.1108/00012530911005517

Kumar, V., Sezersan, I., Garza-Reyes, J. A., Gonzalez, E. D., & Al-Shboul, M. A. (2019). Circular economy in the manufacturing sector: Benefits, opportunities, and barriers. *Management Decision*, *57*(4), 1067-1086. https://doi.org/10.1108/MD-09-2018-1070

Lieder, M., & Rashid, A. (2016). Towards circular economy implementation: A comprehensive review in context of manufacturing industry. *Journal of Cleaner Production*, *115*(1), 36-51. https://doi.org/10.1016/j.jclepro.2015.12.042

Linder, J. C. (2006). Does innovation drive profitable growth? New metrics for a complete picture. *Journal of Business Strategy, 27*(5), 38-44. https://doi.org/10.1108/02756660610692699

Liu, L., Liang, Y., Song, Q., & Li, J. (2017). A review of waste prevention through 3R under the concept of circular economy in China. *Journal of Material Cycles and Waste Management*, *19*(4), 1314-1323. https://doi.org/10.1007/s10163-017-0606-4

McDonald, S., & Oates, C. (2003). Reasons for non-participation in a curbside recycling scheme. *Resources, Conservation & Recycling*, *39*(4), 369-385. https://doi.org/10.1016/S0921-3449(03)00020-X

McDonough, W., Braungart, M. (2002). *Cradle-to-Cradle: Remaking the Way We Make Thing*. New York, NY: North Point Press.

Moore, S. B., & Manring, S. L. (2009). Strategy development in small and medium sized enterprises for sustainability and increased value creation. *Journal of Cleaner Production*, *17*(2), 276-282. https://doi.org/10.1016/j.jclepro.2008.06.004

Murray, A., Skene, R., & Haynes, K. (2017). The circular economy: An interdisciplinary exploration of the concept and application in a global context. *Journal of Business Ethics*, *140*(3), 369-380. https://doi.org/10.1007/s10551-015-2693-2

Murray, S., & Larry, S. (2009). *Statistics*. Mexico: McGraw-Hill.

Nubholz, J. L. K. (2017). Circular business models: Defining a concept and framing an emerging research field. *Sustainability*, 9(1), 14-17. https://doi.org/10.3390/su9101810

Nunally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory*, 3 ªEd. New York, NY: McGraw-Hill.

OECD (2017). *Enhancing the Contributions of SMEs in a Global and Digitalized Economy*. Paris: OECD.

Ongondo, F. O., Williams, I. D., Dietrich, J., & Carroll, C. (2013). ICT reuse in socioeconomic enterprises. *WASTE Management*, *33*(12), 2600-2606. https://doi.org/10.1016/j.wasman.2013.08.020

Ormazabal, M., & Puga-Leal, R. (2016). An exploratory study of UK companies taxonomy based on environmental drives. *Journal of Cleaner Production*, *133*(2), 479-486. https://doi.org/10.1016/j.jclepro.2016.06.011

Ormazabal, M., Prieto-Sandoval, V., Jaca, C., & Santos, J. (2016). An overview of the circular economy among SMEs in the Basque Country: A multiple case study. *Journal of Industrial Engineering Management*, *9*(8), 1047-1058. https://doi.org/10.3926/jiem.2065

Ormazabal, M., Prieto-Sandoval, V., Puga-Leal, R., & Jaca, C. (2018). Circular economy in Spanish SMEs: Challenges and opportunities. *Journal of Cleaner Production*, *185*(1), 157-167. https://doi.org/10.1016/j.jclepro.2018.03.031

Ormazabal, M., Sarriegi, J. M., Barkemeyer, R., Viles, E., & MacAnulla, F. (2015). Evolutionary Pathways of environmental management in UK companies. *Corporate Social Responsibility and Environmental Management*, *29*(1), 169-181. https://doi.org/10.1002/csr.1341

Papke-Shields, K. E., Malhotra, M. J. & Grover, V. (2002), Strategic manufacturing planning systems and their linkage to planning system success, *Decision Science*, *13*(1), 1-30. https://doi.org/10.1111/j.1540-5915.2002.tb01634.x

Park, J., Sarkis, J., & Wu, Z. (2010). Creating integrated business and environmental value within the context of China's circular economy and ecological modernization. *Journal of Cleaner Production*, *18*(15), 1492-1499.

https://doi.org/10.1016/j.jclepro.2010.06.001

Porter, M., & Van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *Journal of Economic Perspective*, *9*(4), 97-118. https://doi.org/10.1257/jep.9.4.97

Prieto-Sandoval, V., Alfaro, J. A., Mejía-Villa, A., & Ormazabal, M. (2016). ECO-labs as a multidimensional research topic: Trends and opportunities. *Journal of Cleaner Production*, *135*(4), 806-818. https://doi.org/10.1016/j.jclepro.2016.06.167

Prieto-Sandoval, V., Jaca, C., & Ormazabal, M. (2018). Towards a consensus on the circular economy. *Journal of Cleaner Production*, *179*(1), 605-615. https://doi.org/10.1016/j.jclepro.2017.12.224

Repo, P., Anttonen, M., Mykkanen, J., & Lammi, M. (2018). Lack of congruence between European citizen perspectives and policies on circular economy. *European Journal of Sustainable Development Responsible*, *7*(1), 249-264. https://doi.org/10.14207/ejsd.2018.v7n1p249

Ritzen, S., & Sandstrom, G. O. (2017). Barriers to the circular economy: Integration of perspectives and domains. *Procedia CIRP*, *64*(1), 7-12. https://doi.org/10.1016/j.procir.2017.03.005

Rizos, V., Behrens, A., Van der Gaast, W., Hofman, A., Ioannu, A., Kafyeke, T., … Topi, C. (2016). Implementation of circular economy business models by small and medium sized enterprises (SMEs): Barriers and Enables. *Sustainability*, *8*(11), 1212-1222. https://doi.org/10.3390/su8111212

Saloj ärvi, S., Furu, P., & Sveiby, K. E. (2005). Knowledge management and growth in finish SMEs. *Journal of Knowledge Management*, *9*(2), 103-122. https://doi.org/10.1108/13673270510590254

Sauvé, S., Bernard, S., & Sloan, P. (2016). Environmental sciences, sustainable development, and circular economy: Alternative concepts for trans-disciplinary research. *Environmental Development*, *17*(1), 48-56. https://doi.org/10.1016/j.envdev.2015.09.002

Segars, A. H., & Grover, V. (1993), Re-examining perceived ease of use and usefulness: A confirmatory factor analysis, *MIS Quarterly*, *17*(4), 517-525. https://doi.org/10.2307/249590

Vargas-Hernández, J. G., & López-Lemus, J. A. (2021). Resources and capabilities of SMEs through a circular green economy. *International Journal of Circular Economy and Waste Management*, *1*(1), 1-15. https://doi.org/10.4018/IJCEWM.2021010101

Yadav, N., Gupta, K., Rani, L., & Rawat, D. (2018). Drivers of sustainability practices and SMEs: A systematic literature review. *European Journal of Sustainability and Development Responsibility*, *7*(4), 531-544. https://doi.org/10.14207/ejsd.2018.v7n4p531

Yang, M. M., Wei, Y., & Lin. L. W. (2014). Integration of industrial ecology approaches into business practices how AU optronics strengthens is green competitiveness in panel industries. *Journal of Industrial Ecology*, *18*(5), 670-676. https://doi.org/10.1111/jiec.12198

Zanoli, R., & Naspetti, S. (2002). Consumer motivations in the purchase of organic food: A means-end approach. *British Food Journal*, *104*(8), 643-653. https://doi.org/10.1108/00070700210425930

Zhang, T., Chu, J., Wang, X., Liu, X., & Cui, P. (2011). Development pattern and enhancing system of automotive components remanufacturing industry in China. *Resources, Conservation & Recycling*, *55*(6), 613-622. https://doi.org/10.1016/j.resconrec.2010.09.015

Zhu, Q., Geng, Y., & Lai, K. H. (2010). Circular economy practices among Chinese manufacturers varying in environmental-oriented supply chain cooperation and the performance implications. *Journal of Environmental Management*, *91*(6), 1324-1331. https://doi.org/10.1016/j.jenvman.2010.02.013