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Improving sustainable supply chains performance through operational excellence: circular economy approach



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ABSTRACT

This work is framed by the search for sustainable supply chain success through new approaches of operational excellence. By applying certain characteristics of Upper Echelons Theory in the context of the circular economy, this study analyzes critical success factors for the adoption of the circular economy using focal companies selected from both emerging (Brazil) and mature (Scotland) economies. Thus, this study relates to the maturity level of circular economy adoption, how well companies manage critical success factors, and the influence of selected characteristics of firms' upper echelons in promoting the circular economy. After conducting two exploratory case studies in Brazil and Scotland, as well as exploring the suitability of four research propositions, this work suggests that: (i) among the firms studied, companies that are more proactive towards the circular economy also demonstrate better management of critical success factors; (ii) based on these cases, companies that are less proactive in terms of the circular economy tend to face greater challenges and tensions due to unmanaged critical success factors; (iii) among the companies studied, those that are most proactive in terms of the circular economy tend to have top management who are more supportive of sustainability; (iv) certain top management characteristics in the companies studied, such as formal sustainability education and understanding of national sustainability strategy, are revealed to be relevant to the adoption of circular economy initiatives; and finally, (v) while our study shows that the theory behind the circular economy and critical success factors for promoting circular production systems have been developing separately, the integration of these important topical issues currently remains scarce.

1. Introduction

This work explores the interfaces of operational excellence and sustainable supply chains (Mangla et al., 2019). Research reveals that operations management has recently begun to embrace sustainability-related topics through operational excellence approaches (Mani and Gunasekaran, 2018; Govindan, 2018), including the circular economy. The circular economy is currently a key topic in the manufacturing industry (Merli et al., 2017; Tukker, 2015; Huang et al., 2009). It is a relatively young field of research, with roots in different disciplines and schools of thought (Merli et al., 2017; Blomsma and Brennan, 2017; Bocken et al., 2017), and one which in recent years has gained importance among companies, policymakers, and researchers alike

(Schroeder et al., 2018). Therefore, operations management – the actual management of operations – is involved in seeking ways to improve sustainable supply chains' performance through operational excellence approaches (Luthra and Mangla, 2018).

Sustainable operations can contribute greatly to excellence in company performance (Luthra et al., 2017), and such operations are essential for the creation of circular economy-based production systems (Mangla et al., 2018a, b). These operations focus on detailed assessment of facility compliance, resource usage and performance, potential effects on the environment and health, supply chain and product life-cycle, and sustainable systems (Manfrin et al., 2013). This paper focuses on improving sustainable supply chains' (SSC) performance. A few studies have already examined this topic; see, for example, Yamak et al.

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(2014); Reike et al. (2018); Tseng et al. (2018), Zhong and Pearce (2018), Simon (2019), and others. However, our study differs from previous research in that it seeks to improve sustainable supply chains' performance through operational excellence approaches, and involves the circular economy and the theoretical lens of Upper Echelons Theory. Furthermore, we specifically compare the situation in both developed and emerging economies, identifying specificities and nuances within each of these contexts.

Both developed (i.e. industrialized capitalist countries) and emerging economies have adopted strategies (Aqlan and Al-Fandi, 2018) to motivate managers to implement circular economy initiatives in their firms (Mirabella et al., 2014; Sehnem et al., 2016). However, in developed economies such as Scotland, there tends to be more structured and rigorous institutional and legal apparatus (Korhonen et al., 2018) to engage companies in the process of becoming sustainable, in order to meet the requirements of the circular economy (Ghisellini et al., 2016; Circular Economy, 2015; Cucchiella et al., 2015; Su et al., 2013; European Commission, 2015a, b, 2014, 2011, 2010; Chinese National People's Congress, 2008; European Parliament, 2008) and to instigate initiatives to stimulate reverse-loop and closed-loop logistical mechanisms (Haddad-Sisakht and Ryan, 2018).

From the perspective of an emerging economy such as Brazil – a nation considered a global center of agribusiness (UNCTAD, 2017) – there is federal concern over the effects of waste on the environment, and that concern has been formalized in Brazil through the National Policy on Solid Waste (Brazil, 2010). This legal guidance (Brazil, 2010) contains important instruments to enable the country to advance in addressing the main environmental, social, and economic problems arising from the inadequate management of solid waste. It requires the prevention and reduction of waste generation and proposes sustainable consumption habits and a set of instruments to increase recycling (Ryen et al., 2018) and the reuse of solid waste; in some cases, a pay-per-use service provider is recommended (Sousa-Zomer et al., 2018). It also establishes the shared responsibility of waste generators: manufacturers, importers, distributors, traders, citizens and owners of urban solid waste management services, such as reverse logistics and post-consumer packaging.

Environmental sustainability in Brazilian firms is evolving progressively (Teixeira et al., 2012). However, a gap still exists, because the circular economy has received continually increasing attention in the last couple of years. Clearly, many opportunities are available to improve sustainable supply chains' performance through operational excellence approaches.

On the other hand, Scotland has been commended as a leading country in terms of the circular economy: "Scotland has been named one of the world's top circular economy nations, receiving a global award for its work to make things last. The Scottish Government – representing itself and its key agencies – was the recipient of the Award for Circular Economy Governments, Cities and Regions at the Circulars Awards, presented at the World Economic Forum Annual Meeting in Davos on Monday 16 January." (Scotland receives..., 2017). At the firm level, it is essential for managers to effectively manage critical success factors that may affect sustainability initiatives. Critical success factors are those factors that require monitoring and action from top management in order to maintain organizational competitiveness (Rockart, 1979). The circular economy journey tends towards innovation, necessitating new business models for sustainability, and this innovative aspect of the circular economy often encounters internal organizational barriers (Long et al., 2018). Thus, identifying critical success factors within the circular economy journey is important in order to encourage organizations to prioritize resources and adjust their management and, in turn, achieve the adoption of circular economy principles.

In this context, the research question that motivates this work is: what are the critical success factors in the adoption of circular economy practices in firms considered focal in their supply chains? What is the best approach to focus on to address/improve sustainable supply chain

(SSC) performance, in the contexts of Scotland and Brazil, from the perspective of selected characteristics of Upper Echelons Theory? Due to the current lack of theoretical background to elucidate critical success factors for the circular economy or for improving SSC performance through operational excellence approaches, this work maybe classified as an exploratory international case study.

The objective of this paper is to analyze critical success factors in the adoption of the circular economy in selected examples of focal companies in both emerging (Brazil) and mature (Scotland) economies. The research methodology is inspired by similar works that have adopted an exploratory case study approach (see Choudhary et al., 2012; Teixeira et al., 2012). In terms of its theoretical background, this work is anchored in Upper Echelons Theory, which assumes that there is a relationship between organizational outcomes and the managerial characteristics adopted by an organization's leadership (Hambrick and Mason, 1984, 2007). The way in which senior managers deal with critical success factors is key to the circular economy (Pitkanen et al., 2016). Understanding the critical success factors for sustainability is therefore relevant for companies that aim to move towards sustainable development (Jabbour et al., 2015).

However, there is still a lack of research integrating the circular economy and Upper Echelons Theory. Hence, this work seeks to identify the critical factors that can support organizations in implementing circular economy practices. Therefore, this article contributes to the literature on the circular economy by exploring the role of top management characteristics in dealing with critical success factors in two contexts (Brazil and Scotland), which may assist improvement of the proactivity level of circular economy adoption within organizations. Additionally, the paper intends to focus on improving SSC performance.

The rationale for choosing Scotland is that this country has made a commitment to the implementation of the circular economy in its legislation (Wicher et al., 2018); this legislation has made Scotland an international benchmark in this field. The rationale for the choice of Brazil is related to the visibility that the circular economy theme has been receiving in this country in recent years. The theoretical nucleus of the circular economy has been created, and it brings together researchers from different educational institutions, industrial federations, entrepreneurs, and sympathizers.

This article is structured as follows: Section 2 describes the theoretical framework, divided into circular economics (Section 2.1) and Upper Echelons Theory (Section 2.2), from which four research propositions are developed; these proposals will be analyzed in light of the evidence from the case studies. Section 3 presents the research methodology. Section 4 explains the research results, and Section 5 presents the discussion. Finally, Section 6 provides the conclusions and final implications of the study.

2. Conceptual background and development of exploratory research propositions

2.1. The circular economy

The circular economy is a concept that ultimately aims to establish a new socioeconomic paradigm (Masi et al., 2017). It seeks to increase the circularity of resources (Babbitt et al., 2018) in the production chain; that is, products, materials (Rowshannahad et al., 2018) and resources are kept in circulation for as long as possible (Merli et al., 2017; Jabbour et al., 2017; Moreno et al., 2016; Ghisellini et al., 2016). This approach aims to change social and economic dynamics, dissociating economic growth from the depletion of natural resources and environmental degradation (Murray et al., 2015).

The theory behind the circular economy is based on two types of cycle: biological and technical (Ellen MacArthur Foundation, 2015). Biological cycles aim to regenerate ecosystems by reducing excessive extraction of natural resources, using renewable materials, and reusing energy and organic waste by means of anaerobic digestion. According

to the [Ellen MacArthur Foundation \(2015\)](#), biological cycles can be implemented through collection, cascade exploitation, extraction of biochemical raw materials, anaerobic digestion, biogas, biosphere regeneration, biochemical raw materials and agriculture/collection. Technical cycles, on the other hand, focus on extending the life of products through a hierarchy of circular strategies, including collection, sharing, maintaining/prolonging, reuse, refurbishment/re-manufacturing and recycling. These technical cycles seek to turn waste into useful resources in other production systems ([Murray et al., 2015](#)).

Several trade-offs are required in the process of transitioning to the circular economy ([Pitkanen et al., 2016](#)). Alignment of multiple goals and negotiation with various stakeholders represent challenges and may generate tensions in the process of migration to a circular business model, as do guarantees of funding, the presence of leaders willing to engage with such initiatives, and the need to learn from experience ([Pitkanen et al., 2016](#)). In this work, challenges and tensions ([Schroeder et al., 2018](#)) will be considered synonyms.

Other critical factors related to the circular economy journey concern technological aspects. The implementation of the circular economy requires the design of products from a circular economy perspective; that is, including sustainable design, the possibility of recycling or re-manufacturing and a sustainable business model ([Moreno et al., 2016](#)). An emphasis on sustainable design strategies may still be viewed as a bottleneck in circular economy implementation. In order to develop circular economy practices, there is a need to invest in industrial synergies through industrial symbiosis, which can be seen as a strategic tool for economic development. Critical to the success of this process are issues of technical, economic, and legal viability; i.e., functionality, convenience, and authorization ([Iacondini et al., 2015](#)). The challenge of efficient use of resources and raw materials ([Iacondini et al., 2015](#)), as well as the use of clean energy, contributes to the development of a green and circular economy ([Mangla et al., 2018a, b](#)), one in which there is concern for synchronization with natural resources ([Haddad-sisakht & Ryan, 2018](#)) and the balancing and recirculation of resources in order to optimize their use, similar to a lean perspective ([Jakhar et al., 2018](#)) with an emphasis on measuring performance to implement sustainable practices in the supply chain ([Raut et al., 2019](#)).

Other aspects cited by [Iacondini et al. \(2015\)](#) are the lack of collaboration between different companies and supply networks, resistance to sharing data on internal waste streams, lack of communication, authority and leadership from managers and economic comfort. In other words, when measures only have a significant impact in the long term, they do not appear attractive from short-term perspectives. There is also a need for regulation to evolve, through laws and legal guidelines that support the circular economy and motivate the development of circular industrial processes ([Iacondini et al., 2015](#)).

Based on the existing literature, the following list of critical success factors for the circular economy can be proposed for this research:

- Stakeholders' belief in the idea of the circular economy
- The perception that customers are not paying for sustainability
- The need for engagement of different stakeholders
- Technological innovations appropriate to the production chain
- Reduction of asymmetries in the knowledge level of employees
- Creation of a sustainable organizational culture
- Recognition that it is difficult to change people's behavior, especially employees and consumers
- Reduction of technological asymmetries in the supply chain
- Reduction of employee turnover
- Dealing with increasing market pressure
- People's need to see results to believe in the idea of a sustainable world (win-win)

Taking into account the characteristics of these critical success factors for the circular economy, it can be argued that the better organizations manage these critical success factors, the better they will be

able to adopt circular economy practices.

As a consequence of this literature review, the following exploratory research propositions are presented:

Exploratory Proposition 1: Based on the cases considered in this work, firms with a more proactive approach to the circular economy tend to manage critical success factors better.

Exploratory Proposition 2: Based on the cases considered in this work, firms with a less proactive approach to the circular economy tend to commonly experience difficulties in managing critical success factors.

2.2. Circular economy-based production systems (CEBPS) and excellence of sustainable operations (ESO)

Circular economy-based production systems and excellence of sustainable operations are methods developed by organizations to increase material circularity, optimization of natural resources and system longevity ([Kirchherr et al., 2017](#)). In this context, the circular economy can be considered an important component in the promotion of sustainable operations ([Zeng et al., 2017](#)). To create a circular economy-based production system, as well as to measure sustainable practices related to circularity in organizations, a series of laws and regulations targeting government, businesses and society have been promulgated ([Pauliuk, 2018](#)). Elsewhere, practices have been developed to conduct risk analysis in green supply chains ([Mangla et al., 2015](#)).

Another way to achieve excellence in sustainable operations is through examination of industrial parks and social dimensions of the circular economy, as well as green production, closed cycle production systems, circularity of materials, circular flow models and firm-level missions. All of these initiatives are strongly incentivized to achieve sustainability goals ([Zeng et al., 2017](#)).

Circular Economy-Based Production Systems (CEBPS) constitute a systematic approach to thinking, developing and creating products; they adopt the premises of the circular economy from the prototype/design phase and manage the critical materials, as cited by [Gaustad et al. \(2018\)](#). They adopt a process of creation, manufacturing, sustainable distribution, and are supported by innovative services that minimize resources, reduce or eliminate toxic substances, adopt zero-waste logic, reduce emissions and emphasize life-cycle analysis of the product ([Sudarsan et al., 2010](#)).

Also relevant is industrial symbiosis, which is recognized as a practical approach to closing the cycle of manufacturing processes ([Chertow and Ehrenfeld, 2012](#)). It transforms the waste of a variety of processes and industries into raw materials for other processes and industries ([Domenech et al., 2019](#)). This enables the transition from linear systems to closed-loop systems ([Wen and Meng, 2015](#)). This has a positive impact on pollution reduction, energy consumption and efficient waste management ([Gaustad et al., 2018](#)). Ecological design, waste prevention and reuse bring net savings to businesses and increase resource productivity ([Kalmykova et al., 2018](#)). Finally, industrial symbiosis is concerned with the extension of product life, eco-efficiency, and re-marketing ([Kalmykova et al., 2018](#)).

Dematerialization and diversification are two principles of circularity that have the potential to contribute to the improvement of vulnerabilities in material supply and risk management, and thus positively impact CEBPS ([Gaustad et al., 2018](#)). The CE benefits from increased reuse and recycling of critical materials ([Jacobi et al., 2018](#)).

In addition, the circular economy contributes to economic growth through the creation of new enterprises, new employment opportunities, material savings and reduction in time, impacts and pressures ([Kalmykova et al., 2018](#)).

2.3. Upper echelons theory

The premise of Upper Echelons Theory is that the experiences, values, and personalities of executives influence their interpretation of the

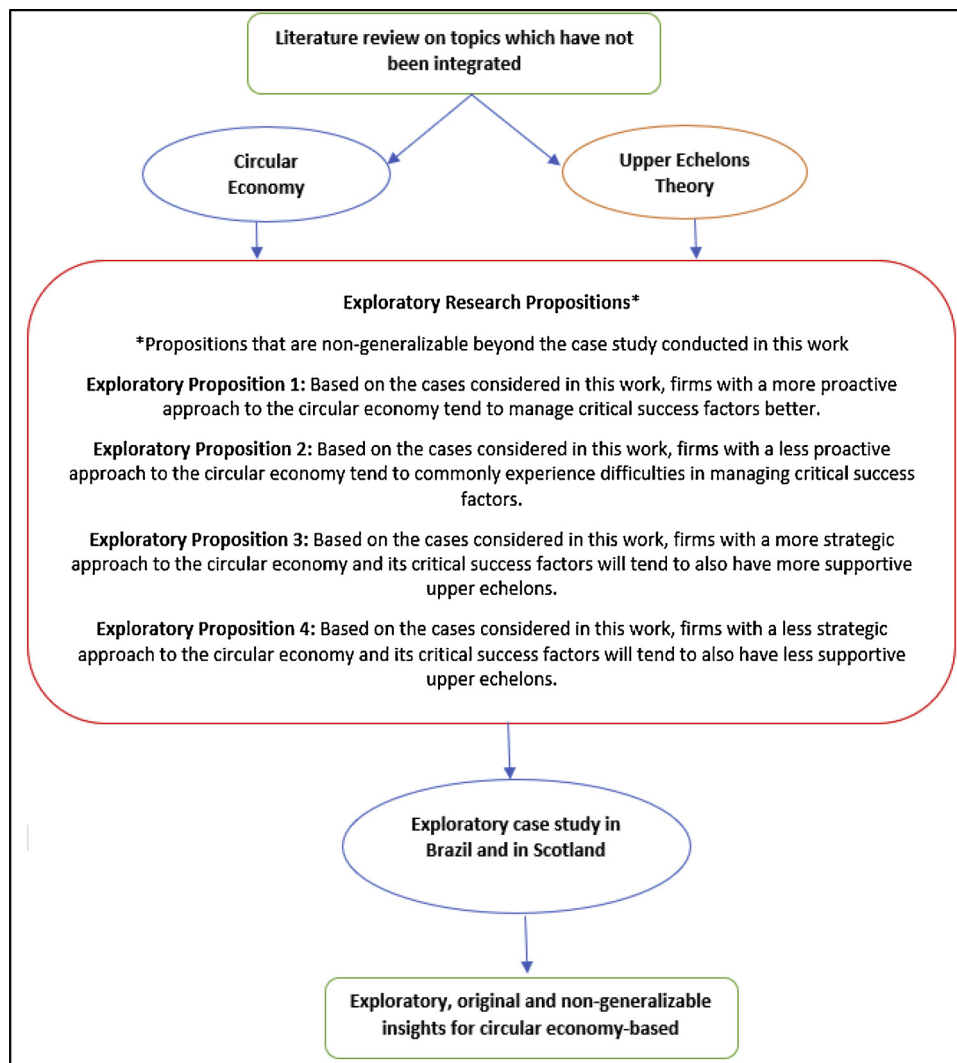


Fig. 1. Exploratory research propositions in this work.

situations they face, and thus affect their choices (Hambrick, 2007). Therefore, according to Upper Echelons Theory, executives act based on their personalized interpretation of the strategic situations they face (Hambrick and Mason, 1984).

Hambrick and Mason (1984) point out that organizational results and performance levels related to strategic choices can be partly predicted by managerial characteristics. Thus, Upper Echelons Theory emphasizes the organization's dominant coalition, and particularly top managers, because it understands organizational results, as well as strategy and effectiveness, as reflections of the values and cognitive foundations of an organization's most powerful actors. Hambrick and Mason (1984) use the independent variables of year, industry and company to interpret variations in performance measures, and these variables prove to be useful predictors of performance. Emphasis is also placed on the observable managerial characteristics of age, organizational tenure, function, education, other career experience, socio-economic background, financial position and company characteristics. In terms of strategic choices, the indicators used are product innovation, unrelated diversification, related diversification, acquisition, capital intensity, plant and equipment novelty, reverse integration, direct integration, financial leverage, administrative complexity and response time. In the performance aspect, profitability, variation, growth and survival are evaluated.

In 2007, Hambrick wrote an updated version of the original work on Upper Echelons Theory. In this later paper, the author emphasizes that

the central premise of Upper Echelons Theory is that experiences, values and personalities greatly influence managers' interpretation of the situations they face and, in turn, affect their choices. At its core, Upper Echelons Theory connects two propositions: first, that executives act on their personalized interpretations of strategic situations and, second, that these personalized interpretations are a function of their experiences, values, and personalities.

Upper Echelons Theory has been deepened over time, and two important moderators that affect the predictive force of the theory have been introduced: managerial discretion and executive work requirements. The theory generally uses defined demographic characteristics of executives, such as age, ethnicity, functional background and education, as observable proxies for underlying psychological constructs that shape the way executives interpret environmental cues and respond to suggestions (Knight et al., 1999). The probability that such stimuli will trigger an organizational response depends on how they are received by the top management team, which, in turn, depends on the organizational context and executives' experiences with the issue at hand.

In this work, the following top management characteristics have been selected for analysis in the case studies:

- Manager age
- Management experience
- Other career experience

- Education
- Company characteristics

Taking into account the characteristics of the aforementioned circular economy critical success factors, it may be argued that Upper Echelons Theory can explain the role of management approach in dealing with these critical success factors, and thus in implementing circular economy practices.

Based on this literature review, it is possible to suggest two further research propositions:

Exploratory Proposition 3: Based on the cases considered in this work, firms with a more strategic approach to the circular economy and its critical success factors will tend to also have more supportive upper echelons.

Exploratory Proposition 4: Based on the cases considered in this work, firms with a less strategic approach to the circular economy and its critical success factors will tend to also have less supportive upper echelons.

Fig. 1 systematizes the exploratory research propositions adopted in this work. Fig. 1 suggests that the existing literature on circular economy-based production systems, including studies that utilize a comparative case study methodology, can be considered relatively scarce. In this context, and following Yin (2010; 1981), it is advisable to conduct a literature review in order to indicate exploratory research propositions, as presented above, which will then be discussed based on qualitative research. In this work, qualitative research, utilizing an exploratory case study methodology in companies from Brazil and Scotland, is presented. The above exploratory research propositions are analyzed by taking into account these cases. It is important to highlight that, as an exploratory case study, our final remarks regarding the research propositions are not generalizable beyond the four cases presented here. Finally, we justify the case study approach selected as our study focuses on a topic in which there is still a ‘gap in existing theory that does not adequately explain the phenomenon under investigation’ (Barratt et al., 2011).

These four exploratory research propositions have been applied to case studies conducted in Brazil and in Scotland through a non-generalizable perspective.

3. Research methodology

Recent research conducted by the authors of this article in major scientific databases reveals that there is no existing research which integrates Upper Echelons Theory with practices and factors critical to the success of the circular economy, while also contrasting emerging and mature economies such as Brazil and Scotland. The databases investigated include Scopus, Ebsco, ISI Web of Science, Sage, Emerald, Elsevier, Wiley Online Library and Science Direct. Certain studies do relate these two constructs (see, for example, Zhong and Pearce, 2018; Yamak et al., 2014). Therefore, there is an opportunity to carry out novel exploratory and qualitative research in this area, based on the multiple case study strategy and comparing developed and emerging economies. In this context, the principles of the exploratory case study approach anchor this work (Yin, 2010, 1981; Barratt et al., 2011). As explained above, by conducting a literature review, four exploratory research propositions have been identified for use in the analysis of data gathered during our exploratory and comparative case studies in Brazil and Scotland. However, due to the exploratory, qualitative nature of this work, our findings should be interpreted cautiously in relation to the cases conducted, and the research results should not be considered generalizable. According to Mills et al. (2010), ‘the exploratory case study investigates distinct phenomena characterized by a lack of detailed preliminary research, especially formulated hypotheses that can be tested.’ In this work, it was not possible to use previously validated hypotheses due to the lack of prior literature on the topic. It is for this reason that we have opted to use exploratory research propositions.

Although not generalizable, according to Yin (2010), case study-based research results may be considered stronger if two or more cases support the same theory. Our work is based on a similar methodological approach to studies by Campos and Vazquez-Brust (2016); Choudhary et al. (2012) and Teixeira et al. (2012). The Brazilian cases analyzed in this research are among the most important companies in the agribusiness sector, with one working in sugar cane production and the other in the refrigeration of poultry, pork, and milk. One of the companies (here in referred to as BRA 1) is listed in ‘Circular Economy 100 Brazil,’ a document by the Ellen McArthur Foundation that presents guidelines to accelerate the transition towards the circular economy; it is cited as a national example of success in the implementation of circular economy practices. The second case – BRA 2 – is an agricultural cooperative with thousands of affiliated farmers, which has characteristics aligned with the premises of the circular economy.

In Scotland, the two companies selected (SCOT 1 and SCOT 2) are both listed in the Zero Waste Scotland Program, which aims to pioneer the adoption of circular economy practices, investing in businesses with a high level of resource circularity and presenting an expansion strategy for emerging economies through the opening of branches and commercial units in different continents.

The exploratory cases in this study will be referred to as BRA 1, BRA 2, SCOT 1 and SCOT 2, and all share a focus on the production of food and packaging. Each case was analyzed based on the research framework presented in Fig. 1, with the intention of exploring the relatively infrequently studied relationship between Upper Echelons Theory and critical success factors for the implementation of the circular economy. It is assumed that the various critical success factors mentioned support circular economy practices with differing levels of effectiveness.

By following the principles of data triangulation in an exploratory case study approach (Yin, 2010), the data collection process for this research utilized multiple sources of data, including interviews with key participants, visits to facilities and firms’ offices and utilization of secondary data collected from reports, websites, and leaflets. Regarding the exploratory interviews, the interview script covered the following topics (a list of key questions used during the interviews can be found in Appendix 1 and was adapted from the study of Sehnem et al., 2019):

- company characteristics;
- circular economy practices adopted;
- critical success factors for the implementation of the circular economy;
- engagement of senior management teams in the process of implementing circular economy practices.

The experience levels of key respondents to the questions were:

- BRA1 - 23 years as a manager;
- BRA2 - 49 years as a manager;
- SCOT1 - 3 years as a manager;
- SCOT2 - 27 years as a manager.

After conducting these interviews, necessary additional information was collected through three phone calls and two Skype meetings with representatives of the organizations studied.

Data were collected through in-depth face-to-face interviews, with a primary focus on the top managers of the organizations. The researchers then coded the collected data. Additional data were collected via in loco observations of the companies’ operational processes, as well as secondary sources (company websites, reports and technical documents publicly issued or made available), in order to improve the validity of the research.

Table 1 presents information on the sources used in each case study. Data analysis was performed by crosschecking the cases to identify existing or emerging relationships between different sources of evidence, as well as through triangulation of data obtained in loco and

Table 1
Data collection process and sources - multiple case studies.

Source	Evidence		BRA2	SCOT1	SCOT2
Company profile	BRA1				
	A large producer of organic sugar cane. Owns approximately 20,000 hectares of cane and has been in the process of transitioning to the circular economy for 15 years.	Third-largest player nationally in the production and distribution of chicken and pork meat. Has approximately 100,000 associated farming families.	Eco-friendly packaging & catering disposables business. Unique biodegradable packaging company. Raw materials are derived from plant fibers, allowing for full post-use recycling.	Organization that takes part in the recovery of materials gathered via reverse logistics, through a partnership project with public officials, to increase the circularity of resources.	
Interview	About 1 hour - recorded	About 1 hour and 15 minutes			About 1 hour and 25 minutes
Documents used in secondary data collection	1) Company website 2) Newsletter with technical specifications 3) Business and sustainability report 4) Informative journal	1) Company website 2) Newsletter with technical specifications 3) Business and sustainability report	1) Company website 2) Newsletter with technical specifications 3) Business and sustainability report 4) Informative journal	1) Company website 2) Newsletter with technical specifications 3) Business and sustainability report 4) Informative journal	1) Company website 2) Business and sustainability report 3) Informative journal
Notes –direct observation	1) Notes taken during visit to conduct interview 2) Technical visit to observe the circular economy practices highlighted by the interviewee	1) Notes taken during visit to conduct interview 2) Technical visit to observe the circular economy practices highlighted by the interviewee	1) Notes taken during visit to conduct interview 2) Technical visit to observe the circular economy practices highlighted by the interviewee and the specifications, quality, and resistance of the products manufactured	1) Notes taken during visit to conduct interview 2) Technical visit to observe the circular economy practices highlighted by the interviewee and the specifications, quality, and resistance of the products manufactured	1) Notes taken during visit to conduct interview 2) Technical visit to observe the circular economy practices highlighted by the interviewee and the recycling center

from secondary sources. Conclusions were drawn from analysis of convergent sources, comparing these with the existing theory (Voss et al., 2002; Jabbour et al., 2017).

For the purposes of this study, we assigned a circular economy maturity level to each company as an exploratory classification according to a continuum ranging from more proactive through partially proactive to less proactive. Critical success factors and upper echelon characteristics were analyzed in the context of each of the companies surveyed.

First, we classified the cases BRA 1, BRA 2, SCOT 1, and SCOT 2 according to determinants of their circular economy practices. Following this process, a classification of the effectiveness of each company's management of circular economy critical success factors was carried out. Finally, we determined how the upper echelons in each company supported this process. The results of this process are presented in Section 4, which also contains quotations from the interviews.

By comparing the exploratory classifications of the companies studied according to circular economy maturity level, adoption of critical success factors and aspects of Upper Echelons Theory, it is possible to suggest some exploratory research results and to present, in a non-generalizable way, the adherence of these cases to the four exploratory research propositions that emerged from the literature review (Fig. 1). This methodological approach has previously been used in studies by Campos and Vazquez-Brust (2016), Choudhary et al. (2012), Teixeira et al. (2012); Jabbour et al. (2017) and Liu et al. (2018), all of which utilized a similar number of exploratory cases as in this work.

4. Results

4.1. Circular economy adoption in the cases studied

In cases BRA 1 and BRA 2, circular economy practices have tended to emerge via a less planned route, rather than from a fully proactive strategy. This is because the sector in which these companies operate (agriculture) is naturally favorable towards circularity. Both organizations operate in the food sector, in which there is the possibility of implementing many circular practices. These practices may include composting, organic production, use of organic fertilization over chemical fertilization, good practices in terms of soil and animal waste management, creation of ecological corridors and islands of biodiversity, separation of biological and technical assets, incentivization of clean energy usage, reverse logistics of pallets, water recycling, animal welfare, implementation of bio-digestion and emphasis on the creation of a sustainable supply chain. This perspective was confirmed by the interviewee of BRA 1: *"We are inspired by nature, biomimetics for waste management that are generated throughout the production chain"* (Interviewee–Company BRA 1).

In the case of company SCOT 1, circular economy practices have developed along a much more structured route, as the company employs a sustainable business model. The circular economy practices that were observed in SCOT 2 rely much more on the institutional context in Scotland – a country that has made significant investments in the circular economy – rather than on proactive action by the company. Companies SCOT 1 and SCOT 2 should be understood in the context of the specific legislation and circular economy practices of Scotland and the United Kingdom, which encourage companies to develop innovative business models that are capable of promoting meaningful social change in the context in which they are implemented, as exemplified by the following comments from the interviewee of SCOT 1: *"We see no value in not being sustainable"* and *"The culture of the people, the values, the strength of the law are elements that favor the investment in sustainable businesses."*

Two of the cases studied, BRA 1 and SCOT 1, can be highlighted for their superior performance in terms of how much of their proactivity has been directed towards alignment with circular economy cycles.

4.2. Circular economy maturity levels in the cases studied

The studies by the Ellen MacArthur Foundation which describe the technical and biological cycles of the circular economy (2013, 2017) were used as a basis to map the level of adoption of circular economy practices in the cases studied. Levels of adoption range from comparatively more proactive (those companies with the highest adoption of technical and biological circular economy cycles) to less proactive (those companies with lower adoption of technical and biological circular economy cycles). The exploratory data collected were based on senior managers' perceptions of how much attention and action they have devoted to each dimension of the technical and biological cycles of the circular economy. It is important to highlight the exploratory nature of this analysis.

As noted in the above discussion of the technical and biological cycles of the circular economy (EMF, 2013), all companies researched have some level of engagement in the circular economy. However, it is possible to suggest that they occupy relatively different levels of proactivity. Regarding the circular economy proactivity level in the cases surveyed, it is possible to classify them along a continuum from "less proactive" to "more proactive." In this context, the following classifications are proposed. The classification of the companies is based on the following methodology. For each circular economy cycle listed in Table 2, based on data triangulation, an approximate percentage of adoption for this practice is calculated. In this context, 100% implies adoption of a specific practice accompanied by a strong perception of the value of this practice by the interviewee. Less than 100% reflects lower levels of either adoption or perceived relevance of a practice in a company.

Starting with the highest performer, SCOT 1 is classified as more proactive in terms of the circular economy, mainly because this company's business model was initially created from the perspective of a high degree of resource circularity and, secondly, because the raw materials used in its production process are 100% sustainable and natural with a high degree of degradability and a very low level of environmental impact caused in the process of recyclability of resources. Therefore, this is a company that has invested in an ecological approach with a high level of green design, aligned with Scottish guidelines for organizations engaged in the circular economy, as outlined in the document 'Making Things Last: the circular economy strategy for Scotland, Securing the future - The role of resource efficiency' (2016). The business model of the company itself is based on circular economy principles. This makes this company the 'most proactive' when compared to BRA 1, BRA 2, and SCOT 2.

BRA1 can also be considered proactive in the circular economy,

mainly because there is a perception that this company is considerably aligned with circular economy cycles. However, opportunities remain for this company to carry out structured investment related to the ecological footprint of product transportation, neutralization of the CO₂ generated in the production process, ecological packaging, reverse logistics of product packaging and reuse of resources. Therefore, ecological design has not been clearly implemented across the entire wholesale, retail, and supply chain consumption of BRA 1.

BRA 2 is partially proactive, since it employs a large number of practices that align with the premises of the circular economy, but these practices are not synergized according to a strategic guideline for the company, leaving the potential for alignment of conduits and promotion of changes in favor of productivity, reduction of waste and efficiency of processes. There was no evidence of effective cooperation with end users to develop cleaner processes and lower resource usage during these processes, but the researchers did perceive concern about compliance. Finally, SCOT 2 is classified as less proactive. It is important to highlight that this classification is an exploratory effort to understand the four cases herein studied, and that this research result should not therefore be generalized.

4.3. Critical success factors for the circular economy

Table 3 explores how well the cases studied manage various critical success factors which may affect the circular economy. Table 3 is based on the perception of the senior managers interviewed on how well their companies are handling a variety of critical success factors. Among the critical success factors which urgently need to be better managed, organizational culture and the engagement of different stakeholders demand the greatest attention and further proactivity from senior managers.

In terms of how well companies manage the critical success factors identified, SCOT 1 stands out as the best performer. This company is followed by BRA 1, BRA 2, and SCOT 2, in that order.

In summary, Table 3 shows that engagement of the upper echelons of a firm in the circular economy may be key to dealing with the critical success factors of the circular economy.

4.4. The role of leaders in effective management of critical success factors for the circular economy

One way to proactively encourage adherence to circular economy practices is to engage an organization's top management in this issue. In accordance with this idea, Table 4 presents some relevant aspects of Upper Echelons Theory.

Table 2
Determinants of the circular economy.

Analysis Category	Company BRA1	Company BRA2	Company SCOT1	Company SCOT2
Technical Cycle	Interviewees' perception of how much attention they have devoted to this circular economy cycle in their company			
Collect	100%	100%	100%	100%
Keep/Extend	100%	100%	100%	100%
Share	100%	100%	100%	100%
Reduce/Reuse	100%	100%	100%	100%
Remanufacture/Refurbish	50%	50%	100%	50%
Biological Cycle	Interviewees' perception of how much attention they have devoted to this circular economy cycle in their company			
Collect	100%	50%	100%	50%
Cascade exploitation	100%	50%	100%	100%
Extraction of Biochemical Raw Materials	50%	50%	100%	50%
Anaerobic Digestion	100%	100%	100%	100%
Biogas	100%	100%	100%	25%
Biosphere Regeneration	100%	100%	100%	100%
Biochemical Raw Materials	100%	100%	100%	25%
Agriculture/Collection	100%	100%	100%	100%
Average	92%	84%	100%	76%
Relative level of proactivity regarding alignment with a circular economy perspective	More Proactive (more than BRA2 and SCOT2)	Partially Proactive (less than BRA1 and SCOT1)	The most Proactive (best performer)	Partially Proactive (less than BRA1, BRA2, and SCOT1)

Table 3
Critical Success Factors for the Circular Economy.

Critical Success Factor	Sources*	How well does your company manage this critical success factor?			
		Company BRA1	Company BRA2	Company SCOT1	Company SCOT2
To make people believe in the idea of the circular economy	C.P. I. S.D. N.	50%	100%	100%	50%
Perception that customers are not paying for sustainability	C.P. I. S.D.	50%	50%	100%	100%
Need for engagement of different stakeholders	C.P. I. S.D.	50%	50%	50%	50%
Technological innovations appropriate to the production chain	C.P. I. S.D. N.	50%	100%	100%	100%
Reduction of asymmetries in the knowledge level of employees	C.P. I. S.D.	50%	50%	100%	100%
Creation of a sustainable organizational culture	C.P. I. S.D. N.	50%	50%	100%	50%
Recognition that it is difficult to change people's behavior, especially employees and consumers	C.P. I. S.D.	100%	100%	50%	50%
Reduction of technological asymmetries in the supply chain	C.P. I. S.D. N.	100%	50%	100%	100%
Reduction of employee turnover	C.P. I. S.D. N.	100%	50%	100%	100%
Dealing with increasing market pressure	C.P. I. S.D.	100%	50%	100%	100%
The need to see results to believe in the idea of a sustainable world (win-win)	C.P. I. S.D.	100%	50%	100%	100%
Average		86.33%	63.63%	90.90%	81.81%
Level of proactivity in managing critical success factors for the circular economy		More Proactive (more than BRA2 and SCOT2)	Partially Proactive (less than BRA1 and SCOT1)	The most Proactive (highest performer)	Partially Proactive (less than BRA1, BRA2, and SCOT1)

C.P. = Company profile.

I. = Interviews.

S.D.: = Documents used in secondary data collection.

N. = Notes - direct observation.

Table 4 highlights potential differences between the manager profiles of the Brazilian and Scottish cases. In the case of the Scottish companies, there is a lower age and a higher level of education among the managers researched. For example, it is clear that the most proactive firm – SCOT 1 – has a young manager in charge of sustainability management. This manager is a recent graduate, and has been in contact with curricula that include sustainability at their core. This characteristic of the upper echelon of SCOT 1 shows that, indeed, the manager's profile can be important for understanding the level of circular economy proactivity in the firms studied. A statement from SCOT 1's interviewee reveals sophisticated thinking on sustainability: "Above all, systems innovation and sustainable design enable us to design circular business models."

It is clear in the Scottish cases that the institutional environment is

key to shaping managers' perceptions of sustainability. Even for SCOT2, which did not show a high level of proactivity towards the circular economy, the company would not have achieved its partial proactivity if it operated in a less sustainable national environment. The perception of the managers of SCOT 1 and SCOT 2 is that Scotland tends to possess cohesion in terms of sustainability policy and that they have gained important lessons and insights, for example from Zero Waste Scotland.

Moving on to Brazil, in the case of BRA1, the manager interviewed held the chairman ship of the organization, giving this senior manager significant power to move sustainability forward. In company BRA2, however, the cooperative system by which the firm is governed produces a more diluted authority and, thus, coordinating sustainability across all its members is not easy. Additionally, the managers of both BRA 1 and BRA 2 stated that they have little formal knowledge of the

Table 4
Relevant aspects of Upper Echelons Theory.

Aspect	BRA1	BRA2	SCOT1	SCOT2
Manager age	50s	70s	20s	40s
Management experience	<ul style="list-style-type: none"> • Agronomist • Engineer 	<ul style="list-style-type: none"> • Trainee • Technical assistant • Industrial director • Presidency of other companies • President for more than 20 years 	<ul style="list-style-type: none"> • Commercial Manager • Director 	<ul style="list-style-type: none"> • Production manager • Director
Other career experience	Other countries around the world	Other countries around the world	European countries	European countries
Education	Bachelor's Degree	Bachelor's Degree	Master's Degree	Master's Degree
Company characteristics	Private organic company	Farming cooperative	Packaging & catering disposables	Charity institution that rethinks, reclaims, reuses and replaces

circular economy, as sustainability management did not feature in the formal education system at the time of their graduations, decades ago. Although their companies show a certain level of alignment with the technical and biological cycles of the circular economy, this alignment was not rigorously or proactively planned by them.

The managers of all companies were also asked about the main lessons they have learned on how to move sustainable production systems forward, and the concept of the circular economy. All interviewees clearly highlighted the following lessons as ‘must-know’ points:

- The importance of engaging employees in sustainable initiatives;
- A genuine belief in sustainability;
- The relevant role played by the government.

However, the Scottish companies also pointed out an essential lesson regarding ‘sustainable design and circularity’, which can be put down to the result of a number of government initiatives, such as Zero Waste Scotland.

All these research results should be understood as an exploratory effort to make advancements in developing what were previously relatively unconnected topics in the literature on the circular economy. Consequently, these results should not be generalized beyond the four cases carried out herein.

5. Discussion

5.1. Exploring the coherence of literature-based research propositions and the cases studied

In this section, the four exploratory literature-based research propositions presented earlier will be discussed alongside the relevant research results from the selected cases. The results relating to Proposition 1 (firms with a more proactive approach to the circular economy manage critical success factors better) and Proposition 2 (companies with a less proactive approach to the circular economy commonly experience difficulties in managing critical success factors) will be presented first.

We found companies SCOT 1 and BRA 1 to be the two most successful companies at managing circular economy practices, and these companies are also the two that best manage critical success factors. SCOT 1 deserves attention because it is the only company that was conceived according to a circular and sustainable business model. On the other hand, BRA 2 and SCOT 2 have relatively less alignment with circular economy cycles, while also being the two cases with less well-managed critical success factors. Table 5 systematizes both the level of circular economy proactivity and the management level of circular economy critical success factors.

In order to discuss the suitability of these research propositions (Proposition 1 and Proposition 2), it is relevant to refer to Fig. 2. This

figure depicts the finding that the most proactive company in terms of the circular economy (SCOT 1) is also the company with the most proactive management level of critical success factors (SCOT 1). BRA 1 has the second-highest level in terms of both the circular economy and the management of critical success factors, reinforcing the alignment pattern. Finally, BRA 2 and SCOT 2 are the companies with lower proactivity, both in terms of circularity and managing critical success factors.

This discussion indicates the suitability of Proposition 1 and Proposition 2, showing that companies with better performance in terms of circular economy also tend to have better management of critical success factors (SCOT 1 and BRA 1). On the other hand, companies with less circularity tend to be the same companies that face difficulties in managing critical success factors (BRA 2 and SCOT 2).

Regarding Proposition 3 (companies with a more strategic approach to the circular economy and its critical success factors will also have more supportive upper echelons) and Proposition 4 (companies with a less strategic approach to the circular economy and its critical success factors will also have less supportive upper echelons), it can be pointed out that both these propositions were also confirmed by the observed results. The exemplary case for suggesting the suitability of both propositions is SCOT 1. This company has the highest levels in terms of taking advantage of the technical and biological cycles of the circular economy, and is also the company with the highest level of well-managed critical success factors among the companies studied. At the same time, SCOT 1's upper echelons represent the management who know the most about sustainability and the circular economy. For example, SCOT 1's founder has wide knowledge of sustainable business models and the circularity of resources. SCOT 1's upper echelons also present the most significant ambitions regarding the creation of a sustainable win-win context for doing business. They are aware of the regulations, constraints, and opportunities regarding operating a company in a circular economy context. Thus, the sustainability awareness and formal education of SCOT 1 is superior when compared with BRA 1, BRA 2 and SCOT 2.

However, while this research provides support for Propositions 3 and 4, it is important to understand that institutional factors, such as the regulatory context, also play a fundamental role in explaining the success of SCOT 1. This is because there is a synergistic effect regarding the interactions between SCOT 1's proactive circular economy approach, superior performance in managing critical success factors, and supportive senior management when compared to BRA 1, BRA 2, and SCOT 2.

5.2. Implications for theory

Implications for management science are desirable, and must be aligned with research objectives and aims. In our case, while the theory around the circular economy and critical success factors for promoting

Table 5
Alignment between maturity level and critical success factors.

Level of proactivity	BRA1	BRA2	SCOT1	SCOT2
Relative level of proactivity regarding alignment with a circular economy perspective	More Proactive (more than BRA2 and SCOT2)	Partially Proactive (less than BRA1 and SCOT1)	The most Proactive (highest performer)	Partially Proactive (less than BRA1, BRA2 and SCOT1)
Level of proactivity in managing critical success factors for the circular economy	More Proactive (more than BRA2 and SCOT2)	Partially Proactive (less than BRA1 and SCOT1)	The most Proactive (highest performer)	Partially Proactive (less than BRA1, BRA2 and SCOT1)

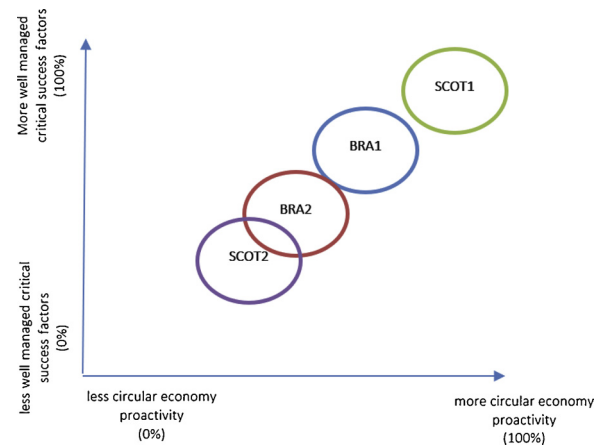


Fig. 2. Alignment between circular economy proactivity and management of critical success factors.

circular production systems have been developing separately, the integration of these important topical issues is still scarce. Even scarcer is comparative real-life evidence on the challenges, tensions, and opportunities regarding this matter. Consequently, the primary contribution of this work is a pioneering approach to understanding the circular economy, critical success factors and support from firms' upper echelons by counter pointing two Brazilian and two Scottish cases. Hence, this work adds to the literature on the circular economy by providing a comparative study of an emerging and a mature economy. So far, this type of comparison has been infrequently presented in the literature.

Another major contribution is that this work substantiates the suitability of the four research propositions initially discussed. These four propositions constitute an original contribution to the state of the art. Many of the main works on the circular economy do not address such propositions.

By recommending the acceptance of research propositions 1 and 2, this research adds to the literature, suggesting that there is a potential relationship between a company's level of circular economy proactivity and how well the company manages circular economy critical success factors. This conclusion reinforces previous works on the relevance of managing critical success factors in order to promote high-level sustainability initiatives. The findings of this research also suggest that the creation of a sustainable organizational culture is a critical factor for succeeding in circular economy implementation, because SCOT 1 – the exemplary case – is the only company which has been able to manage this factor. Thus, managers should prioritize efforts in this area in order to progress in the adoption of circular economy cycles.

Another original addition to the literature is the suggestion of the suitability of Propositions 3 and 4. These propositions affirm that firms' upper echelons play a key role in promoting circular economy proactivity. These propositions were borne out in this work, as there is evidence that SCOT 1 – the most proactive firm in our sample – has the most sustainability-supportive senior management. In SCOT 1, the high level of sustainability awareness among senior managers, formal education on the topic, direct contact with Scotland's key sustainability strategies and profound knowledge of the circular economy make the difference. SCOT 1 demonstrates synergy between high levels of circular economy proactivity and good management of critical success factors, as well as simultaneously having the most sustainability-friendly senior management team of the companies studied. Consequently, it is possible to suggest the relevance of firms' upper echelons when pursuing a truly proactive circular economy strategy.

Conversely, another statement from Upper Echelons Theory deserves attention, due to the fact that executives' experience appears not to be necessarily pivotal in making intelligent decisions regarding the circular economy. For instance, while the interviewee from BRA2 has

much experience as a senior manager, BRA 2 was not classified as having a high proactivity level in terms of the circular economy. It seems that senior managers' level of sustainability awareness and formal education on the topic are important to their managerial approach towards the circular economy. As a consequence, future research should analyze other managerial characteristics in order to understand how these influence managers' decisions regarding circular economy issues.

We wish to add that Upper Echelons Theory might not on its own be sufficient to understand the success of SCOT 1. SCOT 1 has clearly benefited from the favorable Scottish context for sustainability. Thus, we wish to highlight that it may be necessary to combine Upper Echelons Theory with other management theories – in particular institutional theory – in order to fully understand the success of SCOT 1.

Above all, the implications for theory can be brought together in a set of mapped and analyzed information that contributes greatly to the superior performance and excellence of operations. This issue is notorious and relevant to the Virtual Special Issue (VSI) of operational excellence for improving Sustainable Supply Chain Performance (Mangla et al., 2019).

5.3. Implications for end users

The managerial implications of this study are associated with the role of critical success factors in enhancing the excellence of sustainable operations. This information is essential for assertive decision-making concerning the excellence of sustainable operations. Although exploratory, the main findings of this research may be useful for both managers and sustainability-related policy makers interested in the four cases selected. Based on the suitability of the four research propositions initially presented for the cases studied here, we suggest the following lessons gathered from this work, which may be useful for stakeholders interested in these cases:

- Lesson 1: Companies can be positioned at different maturity levels in terms of the circular economy. It is important both for managers and policy makers to understand their firm's current circular economy level and, based on this, plan how to achieve proactivity.
- Lesson 2: Companies which want to advance towards circular economy proactivity should pay attention to properly managing critical success factors; in particular, the creation of a sustainable organizational culture.
- Lesson 3: Characteristics of a company's upper echelons, such as formal sustainability education and understanding of circular economy principles by senior managers, constitute key elements of successful cases of circular economy implementation.

For policy makers, the crucial aspect is creating an ideal setting for companies to achieve proactivity in managing circular economy practices.

However, it is necessary to understand that these research discussions and implications should be considered within the scope of the case study herein presented. This work is based on four cases, and most of these research results can therefore not be generalized beyond these specific cases, their scope and context.

6. Conclusion

This paper focuses on addressing/improving SSC performance by examining and adopting circular economy practices in synergy with Upper Echelons Theory. With Upper Echelons Theory as a background, we anchored our work in four exploratory research propositions that emerged from theoretical pillars of the circular economy, and explored their alignment with the research propositions of four exploratory cases – two from Brazil and two from Scotland – all of which are attempting to adopt a circular economy approach. Although not generalizable, the

research results show that those cases which have a more proactive stance in adopting circular economy practices tend also to have more effective management of circular economy critical success factors; the best-performing firms are also supported by top management whose management profile is aligned with sustainability and the circular economy.

It is possible to suggest that attention to critical success factors can contribute to increasing a company's competitive advantage, create a differential in its sector of operation and generate a better fit between the practices adopted and circular economy performance, all of which will positively affect the company's performance. Another relevant aspect suggested by this study is that the combination of institutional context and management characteristics tends to be relevant to promoting a more proactive circular economy strategy, which is in accordance with the findings of Gaustad et al. (2018). However, this suggestion should be developed further through future studies on the circular economy.

Anchored in these exploratory research results, a brief research agenda for advancing this topic is proposed. This research agenda may include conducting a robust quantitative study on the correlation between critical success factors and adoption of circular economy practices. Longitudinal studies could be carried out, which may contribute to the understanding of variations in relevant characteristics over time, either through the study of events or of circular practices that are gradually being incorporated into organizations, their measurement metrics, and performance indicators. This proposed research agenda may be useful for overcoming the natural limitations of this exploratory research based on selected cases.

6.1. Research limitations and non-generalizable research findings

Finally, it is important to recognize that this work has certain limitations in terms of its reduced number of cases and attendant low generalizability, which is natural in exploratory research. It is important to make it clear that this work is a pioneering effort to link the circular economy, critical success factors, and Upper Echelons Theory in order to understand circular economy-based production systems in selected cases from two countries (Brazil and Scotland). As with any original research on an emerging economy, such as the topic adopted here, our research has a number of idiosyncratic limitations which should be taken into account. The main limitations of this work are as follows.

The conduct of international research (such as a comparative case study between companies in Brazil and Scotland) can be considerably complex. This complexity led us to study only four exploratory cases: two in Brazil and two in Scotland. We thus recognize that the sample used in this work is quite modest, although it is not significantly different from the number of cases analyzed in other papers (e.g., Campos & Vazquez-Brust, 2016; Choudhari et al., 2012; Teixeira et al., 2012).

Exploratory case studies do not generally adopt already validated and previously published quantitative hypotheses, due to the inherent lack of literature on the topic being explored (Mills et al., 2010). In this context, the case study approach can utilize exploratory research propositions that emerge from conceptual principles. In this work, we adopted four exploratory research propositions to guide the analysis of results. It is necessary to make it clear that our findings concern the four cases selected, and that our research results should not be generalized.

Consequently, this work makes use of an exploratory, qualitative approach based on case study due to the novelty of the topic. However, the findings of this work will not replace conclusive, quantitative research, with robust testing of hypotheses and validation of scales.

Additional quantitative, probabilistic, and conclusive research to better understand circular economy-based production systems in different national contexts is suggested to be conducted in future.

Some interesting dimensions for future research in the area of sustainable operations and performance improvement include looking for

performance measurement indicators and the value of adopting circular economy practices with the vision/skills contributed by Upper Echelons Theory.

Appendix A. Example of Key Questions used during the interview process

The questions posed during the interviews were based on – although not limited to – the following items

- Please explain the history of this company.
- What do you understand by ‘circular economy’?
- Please explain the history of your company towards ‘circularity.’
- How have you incorporated the circular economy into your business?
- What are the main drivers for implementing circular economy-related principles?
- What are the main challenges and tensions for adopting circular economy practices?
- What is the role of top management support in promoting sustainability-related initiatives?
- What is the role of top management in adopting circular economy practices?
- What are the main characteristics of the top management players who support the circular economy in your company?
- Please describe key attributes concerning the profile of senior managers who are in charge of sustainability.
- What personal characteristics do you believe are central for promoting the circular economy?
- Please explore the investment of your company in promoting the circular economy, such as investment in training, capacity building, etc.
- What is the role of your company’s stakeholders in your strategy for circular economy-based production?

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