

Process of strategy formulation for sustainable environmental development: Basic model



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ABSTRACT

Although there are substantial benefits by using an adequate strategy in order to reach competitive advantage, little attention has been given to the strategy formulation process for environmental sustainability. The aim of this research is to propose a basic model to formulate strategy for companies that compete pursuing the sustainable environmental development. Based on a literature research of 231 papers, 14 papers were selected and analyzed in detail using content analysis. These papers were categorized into 10 strategy perspectives and compared to the criteria of the Fields and Weapons of the Competition model. From this comparison, a basic process of strategy formulation was devised. The originality and practical implications of this research is to present a basic, adaptable model that can guide entrepreneur, executives and leaders in the process of strategy formulation for sustainable environmental development, especially in times when companies become surrounded by so many environmental sustainable initiatives that confuse rather than guide.

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1. Introduction

Academic research to study ways to improve the competitiveness of industries involves resources and research around the world (Contador, 2008; Mintzberg et al., 2009; Lana, 2011). Much research has been done to identify the factors that can conduct the companies to reach success (AlFaris et al., 2016; Baumgartner and Engert, 2016; Martens and Carvalho, 2016).

The fast industrialization of most of the countries, with excessive consumption of water, energy and raw materials, or the lack of concern about the environmental and social impacts, disturb and undermine the development of the population as a whole (Amate and De Molina, 2013; Onu et al., 2017; Xu et al., 2017).

Abbreviations: BSC, Balanced Score Card; CAC, *Campos e Armas da Competicao* (in Portuguese), Fields and Weapons of the Competition; COSO, The Committee of Sponsoring Organizations of the Treadway Commission; DC, Dynamic Capacity; ERM, Enterprise Risk Management; MCS, Management Control System; MPLF Foresight, Multiplatform Foresight; RBV, Resource-Based View; RBV-C, Resource-Based View Contingent; SAP, Strategy as Practice; SCS, Sustainable Control System; SD, System Dynamics; SVM, Sustainable Value Method; WCED, World Commission on Environment and Development.

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The current industrial model can no longer be maintained. A new industrial model shall spread all over the world, with the companies taking into account environmental factors in their actions (Seiffert and Loch, 2005), so that the social and economic development cannot be threatened (Song et al., 2015; Zamorano et al., 2011). There is an urgent need to change unsustainable production and social standards for new sustainable ways, considering global, national, sectoral and individual levels (Almeida et al., 2015). In this context, there was an intensification in research upon the so called “green industries”, which would produce reducing emissions, decreasing raw material consumption and the damage to the environment, contributing to a sustainable and economically viable future (Anityasari and Rachmat, 2015; Chen et al., 2017; Zhang et al., 2017). However, this change in the competitive priority is not simple to implement (Taisch et al., 2015). The development of operations aligned to the idea of achieving sustainable environmental development, in parallel with the improvement of social and economic performance, requires investments that must be planned strategically (Robèrt et al., 2002).

The understanding of these strategies varies both in relation to the use of methods and tools to be adopted as in respect to the formulation of the strategy (Almeida et al., 2015). Some authors support strategies formulated as guides to the actions to be taken

by companies (Nguyen and Hens, 2015) or governments (Murakami et al., 2015), while other authors believe that the strategies should emerge from a behavioral pattern, such as the search for innovative solutions for the use of raw materials (Wolff et al., 2015). However, there is a general agreement that strategy is essential to align the usage of production resources, research and development, maintenance, and quality. If there is no consensus on what methods, processes and resources to use, there can be no way for the company to achieve its goals (Korhonen, 2007).

Despite the substantial benefits of using an appropriate strategy to achieve competitive advantage (Barney, 1991; Freeman and Reed, 1983; Porter, 1998, 1996), few studies have focused on a strategy formulation process model, and scarce has presented a basic model to guide the process of strategy formulation directed to the companies that compete pursuing the sustainable environmental development, what is a gap. The aim of this research is to provide a basic model to formulate strategy for companies that compete pursuing the sustainable environmental development, able to be adapted to specific situations.

The next section presents a summary of the existing literature on strategy, sustainability and sustainable development. Section 3 provides the methodological procedure applied, while section 4 presents the results of the comparison of the 10 strategy perspectives compared to the criteria of the model of Fields and Weapons of the Competition (*Campos e Armas da Competicao*, in Portuguese – CAC), outlines relevant discussion and presents the basic model of strategy formulation. Section 5 presents the conclusions, identifies the limitations of the present research and provides directions to future research.

2. Theoretical background

Several authors define strategy in different ways, depending on the approach to be used; furthermore, there are several strategy schools that differ, according to the field or the assumptions of each author (Drew, 1999; Hafsi and Thomas, 2005; Jarzabkowski and Wilson, 2006).

For companies, strategy can be defined as the search for a favorable and sustainable competitive position against the forces that determine competition in industry (Porter, 1996). Strategy has served as a roadmap for making decisions on the relationships with opponents, whose reactions cannot be predicted (Zaccarelli, 2000); it would be a way to compete for the preference of the customers among competing companies (Contador, 2008).

Strategy formulation for sustainable environmental development should take as a core target at least one of the sustainability definitions (World Commission on Environment and Development (WCED), 1987), such as “sustainability is the ability of a dynamic, stochastic, purposeful system to continue into the future” (Hansen and Jones, 1996), also caring about global poverty, technological limitations, and social organizations (Bansal and Desjardine, 2015; Newman, 2006). Holling (2001) defines sustainability as the ability to create, test and maintain adaptive capacity. Thus, strategy formulation for environmental sustainability development should target creating and adopting adaptive capacities, turning the process of environmental management evolutionary in nature (Newman, 2006). Since sustainable development refers to a process (Holmberg and Robèrt, 2000; Korhonen, 2007; Missimer et al., 2010), strategy on this field must be flexible in order to accommodate new concepts and understandings (Crate, 2006). In this context, several organizations have adopted the triple bottom line concept, emphasizing three sustainability pillars: environmental, social (or socio-cultural) and economic (Elkington, 2004). Strategies under this perspective were adopted to support discussions on

sustainable manufacturing (Vigtal and Rolstadas, 2010), water reuse (Upadhyaya and Moore, 2012), society (Åhman, 2013), ecosystem management (Voss et al., 2014.) and others.

Some authors introduced new pillars to the triple bottom line, such as economic development, environment and employment (Hwang, 2014), economic, ecological, social and religious values (Johnston, 2010; Tucker, 2008), social, economic, ecological, institutional profile and physical resources (Akgün et al., 2012). Other authors maintain that environmental sustainability is intrinsically tied to the management of environmental resources (Daly, 1990; Odum, 1996) and environmental services (Giannetti et al., 2011a, 2011b).

The campos e armas da competicao model - CAC (Fields and weapons of the competition)

Developed by Contador (2008) Fields and Weapons of the Competition model (*Campos e Armas da Competicao*, in Portuguese – CAC) represents the way companies compete, being one of the scarce models that presents a process to formulate the competitive strategy.

This process takes into account some factors to formulate strategy, that are: (1) the understanding of the competitive context; evaluation of (2) opportunities, (3) threats and (4) risks; (5) customers; (6) competitors; (7) evaluation of the resources to win and/or maintain competitive advantage; (8) formulation of alternatives of competitive strategy; (9) check the consistency of the formulated business competitive strategy, and (10) evaluation of the outputs to check process and strategy.

Factors can be defined as important elements of analysis to which systematic attention must be given, by contributing directly to the generation of results (Baumgartner and Engert, 2016; Law and Gunasekaran, 2012; Székely and Knirsch, 2005).

The thesis of CAC states that for a company to be competitive it is important to have high performance in the few weapons that can provide competitive advantage in the fields of the competition chosen for each pair product/market (Contador, 2008).

Business competitive strategy is the one promoted by a company or business unit for positioning the company or a product in a market.

Operational competitive strategy is the internal action of a company necessary to implement the business competitive strategy.

Fields of the competition is the imaginary *locus* of contest among companies or among products for the preference of the customers, in which the companies try to do their best to reach and maintain a competitive advantage.

Competitive advantage is the position of superiority reached by a company, valued and recognized by the customers, allowing a company to be more competitive than their competitors or than itself in the past.

Weapons of the competition are any resources or activities done and/or organized by a team of employees with similar functions, used by companies to reach and/or maintain competitive advantage, such as: equipment, individual abilities of the employees, information technology, advertisement, which are not the direct interest of the customer. The weapons of the competition directly originate the competitive advantage.

3. Method

Literature research can be understood as content analysis, where quantitative and qualitative facets are combined to assess descriptive contents. The material to be collected is defined and

delimited, providing the context for theoretical investigation (Meredith, 1993). Associated analytic groups were selected and applied to the collected material, which was then examined, according to the contents allowing identification of pertinent issues and interpretation of results (Creswell, 2012). In the approach here adopted, dimensions and categories were classified to form the baseline for the literature research presented in this paper.

The content analysis emphasized papers researching strategy formulation processes for sustainable environmental development, mainly the ones where a logic model and/or a process has been established. The literature research took two phases, presented in Fig. 1.

1st Phase – This research began in early 2016. Initially, this study analyzed the proceedings of the 4th International Workshop Advances in Cleaner Production, whose thematic was linked to the objectives of this research “Integrating cleaner production into sustainability strategies”, held in Sao Paulo, Brazil, in 2013. This study also analyzed the Special Volume of the Journal of Cleaner Production No. 96, 1 June 2015, which emphasized sustainable strategies that published the best papers of the workshop previously mentioned, among others, researching a total of 55 papers, where 5 papers that had indications of the strategy formulation process were selected.

2nd Phase – The research used the Science Direct database to focus on relevant scientific publications concerned about the environmental cause, using as search engine the keywords: strategy and sustainability, in the period from 2005 to 2015. It generated 2510 papers, refined into 176 papers, where 9 papers could be selected. This study analyzed 231 papers in total and selected 14, for directly dealing with formulation of strategy, although this was not the main objective of some of these selected papers, a limitation of the adopted methodology, but that had the benefit of directing to authors focused on sustainable environmental development. In these 14 papers, this research identified ten different strategy perspectives to support the formulation process. Although these selected papers have discussed strategy, scarce models have provided guidance on how to formulate a strategy that can bring competitive advantage.

The strategy formulation processes of these 14 selected papers were compared with the CAC model to verify the consistency of these models.

4. Results and discussion

Table 1 lists the 14 selected papers and their relations with the ten strategy perspectives employed for the formulation of competitive strategy in sustainability and CAC.

The distribution of the publications presented in Table 1

Table 1
Strategy perspectives used in the selected papers.

Perspective	Papers
Stakeholder	(1) Heikkurinen and Bonnedahl (2013) (2) Law and Gunasekaran (2012) (3) Oertwig et al. (2015) (4) Székely and Knirsch (2005)
RBV Contingent (RBV-C)	(5) Wahyuni and Ratnatunga (2015) (6) Aragón-Correa and Sharma (2003)
Strategy as Practice (SAP)	(7) Egels-Zandén and Rosén (2015)
Balanced Score Card (BSC)	(8) Sánchez (2015)
Sustainable Value Method (SVM)	(9) Henriques and Catarino (2015)
Enterprise Risk Management (ERM)	(10) Subramaniam et al. (2015)
System Dynamics (SD)	(11) Marshall and Brown (2003)
Sustainable Control System (SCS)	(12) Gond et al. (2012)
Dynamic Capacity (DC)	(13) Eisenhardt and Martin (2000)
MPL Foresight (MPLf)	(14) Destatte (2010)
Fields and Weapons of the Competition (CAC)	(15) Contador (2008)

indicated that there is no consensus in favor of a unique perspective for strategy formulation. Some of these papers intended to improve known strategies, such as Stakeholder perspective and RBV. Heikkurinen and Bonnedahl (2013) proposes a strategy perspective oriented to sustainable development, while Oertwig et al. (2015) emphasize the alignment between planning and operational control, and Destatte (2010) introduces a strategy perspective with environmental issues related to the future of the company forecasted for long time periods. Some researchers focus on how companies can gain competitive advantage in sustainability (Law and Gunasekaran, 2012; Székely and Knirsch, 2005). Aragón-Correa and Sharma (2003) used RBV Contingent, concluding that the organizational environment influences the strategy, but it does not determine the strategy to be adopted; it is supported by empirical studies of Wahyuni and Ratnatunga (2015), which analyzed two companies operating in the same power market in Australia, showing that each company had adopted a different strategy perspective to face carbon risk exposure.

Table 2 summarizes the 10 strategy perspectives used in the 14 selected papers and CAC.

Despite all the strategy perspectives detailed in Table 2 try to provide competitive advantage, leaders, entrepreneurs and opinion-makers are faced with a number of initiatives concerning corporate sustainability that confuse rather than guide them (Lozano, 2012).

Table 3 presents the comparison of the 10 factors of analysis proposed by CAC to formulate strategy and the 14 selected papers.

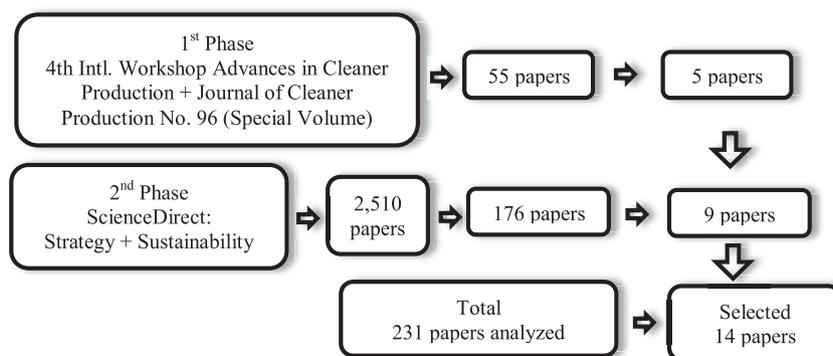


Fig. 1. The literature review process.

Table 2
Summary of the 10 strategy perspectives used in the 14 selected papers and CAC.

Strategy Perspective	Description	Strategy formulation process for environmental sustainability			
		How does it address sustainability?	Strong Points	Considerations	References
Stakeholder Perspective (SP)	Proposes to create the maximum possible value for stakeholders, which are groups primarily formed by shareholders and company owners. This perspective states that other interested groups also need to be taken into account in the formulation process of the strategy, such as employees, political groups, customers, unions, government/regulatory agencies, suppliers, trade associations, funders, communities, even competitors and others.	Working under the Government/Regulatory Agencies rules. Trying to establish a good neighborhood policy with the community.	Environmental sustainability issues can be incorporated naturally.	Does not present/ suggest a strategy formulation process.	Freeman and Evan (1990) ; Freeman and Liedtka (1997) ; Freeman and Reed (1983) ; Heikkurinen and Bonnedahl (2013) ; Law and Gunasekaran (2012) ; Oertwig et al. (2015) ; Székely and Knirsh (2005)
Resource-Based View (RBV)	Under this perspective, company can create competitive advantage from its resources and capabilities. The company controls the resources (tangible and intangible assets) that can be used to generate or implement strategies. Capabilities enable the company to take advantage of the resources it holds. The competitive potential should be analyzed through the parameters: Valuable, Rare, Inimitable and Non-substitutable.	Using the internal resources/ capabilities to set up innovative products that attend environmental sustainability.	Focuses on the internal resources/ capacities of the company to reach success.	1) Does not present/ suggest a strategy formulation process. 2) Environmental sustainability issues are incorporated according to interests.	Barney (1991) ; Jensen et al. (2016) ; Lioukas et al. (2016)
Resource-Based View Contingent (RBV-C)	The perspective of contingency is incorporated into the model of RBV that shall then consider resources and internal capabilities, combined with external factors that may influence the company.	Using the internal resources/ capabilities to set up innovative products to attend the external demand of environment respect.	Presents a strategy formulation process for corporate environmental sustainability.	Emphasis on uncertainty, complexity, and munificence.	Aragón-Correa and Sharma (2003) ; Wahyuni and Ratnatunga (2015)
Strategy as Practice (SAP)	From this strategy perspective, questions are: What does it take to be an effective practitioner of strategy? Who formulates? What is formulated? How is it formulated? What is used? What implications does this have to do with the strategy formulation? It addresses the strategy by the human side, whose emotions, motivations and actions end up shaping the strategy and focusing on the micro processes on a daily basis.	Motivating the human actors to focus on environmental issues.	Concerned with the actions and interactions of the practitioners of the strategy, the social aspect.	1) Does not present/ suggest a strategy formulation process. 2) Environmental sustainability issues are incorporated according to interests.	Egels-Zanden and Rosén (2015) ; Jarzabkowski and Spee (2009) ; Whittington (1996)
Balanced Score Card (BSC)	A management tool for creating and implementing strategy. It focuses on four performance indicators: financial, external customers or marketing, learning and growth, and internal or production processes. BSC seeks to transform mission and values in a comprehensive set of goals that can then be measured and evaluated.	Incorporating environmental goals to the four original performance indicators.	Focused on the strategy implementation. Easy to control.	1) Strategy formulation process is left intuitive, as no process is suggested. 2) Difficulty to respond to the environmental changes.	Kaplan and Norton (2004) ; Sánchez (2015)
Sustainable Value Method (SVM)	SVM intends to increase the value of the company, taking into consideration the economic, environmental and social aspects. Eco-efficient production, understood as the capacity to provide products or services with minimal environmental impact, becomes a management strategy to achieve sustainable development, with reductions in the consumption of materials and energy, and also with reductions of waste and pollution.	Proposing an eight-phase plan for the strategy formulation.	1) Eco-efficiency seen as a strategy to reach sustainable development 2) Proposes a strategy formulation process.	Focused on: 1) Internal resources/ capacities. 2) Operational processes. 3) Internal areas and activities.	Henriques and Catarino (2015)

Table 2 (continued)

Strategy Perspective	Description	Strategy formulation process for environmental sustainability			
		How does it address sustainability?	Strong Points	Considerations	References
Enterprise Risk Management (ERM)	ERM is defined as a process that deals with risks and opportunities that may affect the value of the creation and preservation of the enterprises, applied in strategy and on the entire company. It identifies potential events that may affect the companies and keep risks within limits.	Stating a strategy formulation process of eight interrelated components, set under four categories: strategic, operations, compliance and reporting.	Is integrated to the management process. Components can influence one another.	1) Objectives must be set in advance. 2) Environmental sustainability issues are incorporated according to interests.	COSO (2004); Subramaniam et al. (2015)
System Dynamics (SD)	SD analyzes how the feedback processes of a system change or generate patterns of behavior to understand the irregular behavior of complex systems.	Leaders must define in advance environmental sustainability as an objective.	Makes possible to analyze current behavior and plan for the future.	1) Objectives/problems must be set in advance. 2) Environmental sustainability issues are incorporated according to interests.	Forrester (1971); Marshall and Brown (2003)
Sustainable Control System (SCS)	Management Control System (MCS) is a formal tool based on procedures and information that managers use to formulate and implement strategy, based on four levels: belief system, limits system, interactive control system and diagnostic control system. SCS based on MCS proposes to align sustainability with the strategy of the company.	Integrating sustainability into the strategy of the company and the use of formal controls to direct strategy formulation/implementation.	Proposes a typology of integration between sustainability and strategy.	Generic strategy formulation process. Not tested empirically.	Simons (1995); Gond et al. (2012)
Dynamic Capabilities (DC)	Firms develop new resources in organizational environment of intense and unpredictable changes, using especially the process of integrating resources, reconfiguring the existing ones, obtaining new resources, or even abandoning those which do not bring competitive advantages. The maintenance of competitive advantage in dynamic markets generally occurs for a short period of time, which requires the creation of a series of temporary competitive advantages, taking the opportunities to generate superior performance.	Adapting to the demands of environmental sustainability.	To adapt to high-velocity markets changes.	1) Does not present/suggest a strategy formulation process. 2) Environmental sustainability issues are incorporated according to interests.	Eisenhardt and Martin (2000)
Multipatform Foresight (MPLf)	MPL Foresight is concerned with issues related to the future of the company forecasted for long time periods. It considers the economic, social and environmental aspects, and the influence of the stakeholders.	Providing a strategy formulation process of seven phases.	Incorporate long-term objectives into strategy.	Generic strategy formulation process.	Destatte (2010)
Campos e Armas da Competicao (CAC, in Portuguese), Fields and Weapons of the Competition	This model states that the company must have high performance in those few weapons that give it a competitive advantage in the competition fields chosen for each product/market. The field of the competition is the imaginary locus of market dispute among products or companies over the preference of the customer. The weapon of the competition is any activity performed by a group or used by the company to achieve and/or maintain competitive advantage, such as advertising, information technology, automation of the production process and others.	Aligning the Field of the competition : Social responsibility (civic and environmental) to the Weapons of the competition : Cleaner production (Reduction of Water and Energy Consumption, Occupational Safety and Health Management, etc.).	Structured strategy formulation process, flexible to incorporate sustainable concerns.	1) New model, tested empirically only in Brazil. 2) Environmental sustainability issues are incorporated according to interests.	Contador (2008)

Table 3
Comparison among the strategy formulations of the 14 selected papers and those of CAC.

Analysis Protocol (Factors of the strategy formulation)	Bases of strategy perspectives															
	Paper No. ^a	Stakeholder				RBV-C		Other perspectives used							CAC	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Show to understand the competitive context? Evaluate:	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
2 Opportunities?	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
3 Threats?	✓			✓	✓	✓				✓		✓	✓	✓	✓	
4 Risks?	✓			✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	
5 Take into account the customers?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
6 Take into account the competitors?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
7 Evaluate the resources of the company to win and/or maintain competitive advantage?	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	
8 Formulate alternatives of competitive strategy?			✓		✓			✓	✓			✓	✓	✓	✓	
9 Check the consistency of business competitive strategy formulated?		✓			✓	✓	✓	✓				✓		✓	✓	
10 Evaluate the outputs to check process and strategy?			✓				✓			✓				✓	✓	

^a The paper number is in reference to Table 1.

Strategy is not an exact science, and a proactive environmental strategy does not always create competitive advantages due to: (a) organizational environment is surrounded by uncertainties, complexities and competitive market (Aragón-Correa and Sharma, 2003), (b) sustainability strategy is complex and full of challenges, and the economic side often conflicts with the social and environmental side (Marshall and Brown, 2003), and (c) reactions of the opponents cannot be predicted (Zaccarelli, 2000). Therefore, the formulation and implementation of strategy is a dynamic and never complete process, given the uncertainties of the organizational environment (Aragón-Correa and Sharma, 2003; Egels-Zanden and Rosén, 2015), so the formulation process must be flexible (Crate, 2006) to support revisions and to adapt to changes in the internal and external business environment. The difficulty is to know when to continue and when to change the process and/or strategy. From these 14 papers, eight proposed new strategy formulation models in sustainable environmental development, and among these papers, three were highlighted for considering 8 factors out of the 10 proposed by CAC to formulate competitive strategy; one based on RBV-C, other supported by the BSC, and one grounded on the SVM. One paper that used ERM and other based on SCS also considered 8 factors, the maximum score in this research.

Despite all authors expressed to understand the competitive process and the importance of the customers, some of the 14 selected papers have not considered important factors of analysis presented in the CAC model that could compromise the formulated strategy. Although the CAC model is relevant, given the coherence of its approach, it is not complete, as the original model is general; therefore, taking advantage of the CAC model flexibility, this study redesigned it, incorporating relevant factors presented in these 14 papers and other found in the academic literature research made, to provide a basic model to formulate strategy for companies that compete pursuing the sustainable environmental development, the CAC-S model, presented in Fig. 2.

According to CAC-S, shown in Fig. 2, the understanding of the (1) competitive context of the business strategy is complex and can affect business as well as operation strategy interchangeably, here differentiated, but in reality not so markedly delimited.

The many factors that affect the strategy formulation for companies which compete pursuing the sustainable environmental development need to be evaluated to analyze the competitive context: (a) market (Bocken et al., 2016; Laari et al., 2017), in which the product disputes the preference of the customer; (b) current and potential customers which buy the products and/or services provided (Heikkurinen and Bonnedahl, 2013); (c) shareholders that invest in the company (Wahyuni and Ratnatunga, 2015); (d) board

that controls the company (Székely and Knirsch, 2005); (e) competitors and newcomers (ignored in 3 of the 14 selected papers) that contend for the same customers/position in a market, whose reaction can be unpredictable and sometimes irrational (Zaccarelli, 2000); (f) internal resources that a company owns to achieve or maintain a competitive advantage (Contador, 2008).

The competitive context can also be influenced by: (g) interorganizational networks (Székely and Knirsch, 2005), voluntary arrangements made among companies, (h) economy/global and/or local context/financial institutions (Henriques and Catarino, 2015) generating conditions/capital for the company to compete/develop locally and/or (i) internationally (Székely and Knirsch, 2005). Politics/special interest groups (j) (Law and Gunasekaran, 2012), (k) minorities (Baumgartner and Zielowski, 2007), (l) Non-governmental organizations (NGO) (Heikkurinen and Bonnedahl, 2013), and (m) media (Oertwig et al., 2015) that can conduct public opinion affecting the company.

Employees (n) (Székely and Knirsch, 2005), (o) labor unions (Baumgartner and Rauter, 2017; Hilsdorf et al., 2017), need to have special considerations, (p) supply chain (Wahyuni and Ratnatunga, 2015), supplying the necessities of the company, (q) government/regulatory agencies (Law and Gunasekaran, 2012), which specify the rules and conditions under which company and products must comply with, are relevant factors of exam.

Climatic, geographical and geological conditions (r) (Wahyuni and Ratnatunga, 2015) and (s) natural resources/raw material (Székely and Knirsch, 2005) are special factors to be evaluated by the companies that participate in the market looking for (t) sustainable development/environmental protection (Henriques and Catarino, 2015) as a competitive differential.

The (u) substitute products that can replace/compete with the ones produced by a company (Prapasongsa et al., 2017) need to be regarded to understand the competitive context, as well as: (v) resources/new technologies (Oertwig et al., 2015) (not analyzed in 4 papers of the 14 selected), (w) research and development and innovation (R&D&I) (Székely and Knirsch, 2005), (x) product quality considerations (Henriques and Catarino, 2015) to satisfy the market, and (y) inbound and outbound logistic (He et al., 2017; Pilouk and Koottatep, 2017) can position a company on a superior level in relation to the competition, or to itself in an earlier stage.

Values (z) (Wahyuni and Ratnatunga, 2015), (α) organizational culture (Oertwig et al., 2015), (β) competencies/know-how (Székely and Knirsch, 2005) experienced by people that compose a company, as well as (γ) power (Clegg, 2006; Kunz et al., 2017; Pettigrew, 1977) exerted by groups inside and outside of a company, influence the performance of a company, taking time to be developed or

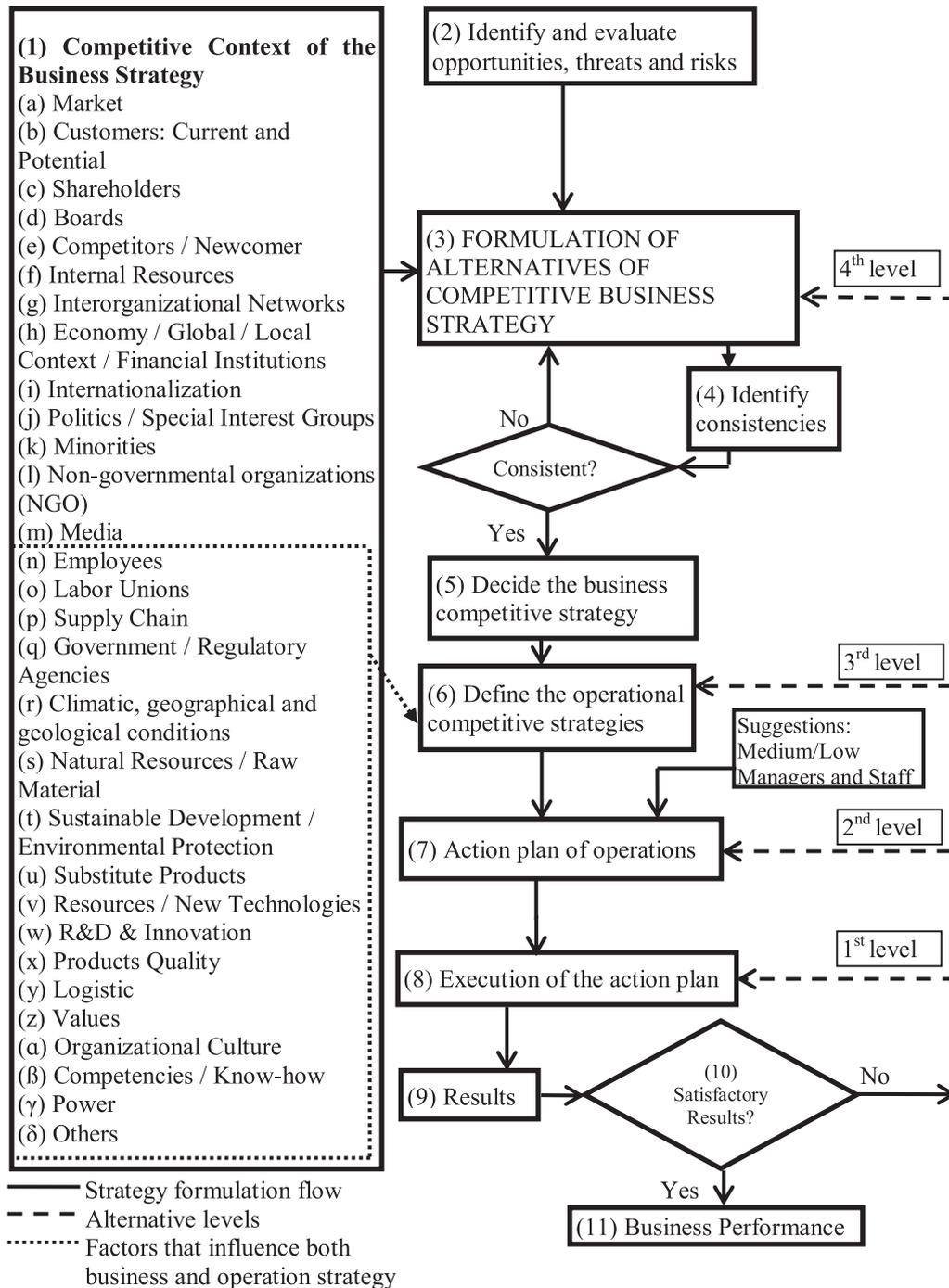


Fig. 2. The formulation process of the business and operational competitive strategy - CAC-S (Source: Adapted from Contador (2008), p.344).

replaced, are also important factors of analysis. Other important factors (δ) can be incorporated to the CAC-S model to understand the competitive context.

It is also relevant (2) identify and evaluate opportunities (disregarded by 2 of the 14 selected papers), threats (not considered by 8 of these 14 papers) and risks (not analyzed by 4 of the selected papers) in which a company is involved. After the study of phases (1) and (2), alternatives (3) of business competitive strategy can be formulated (not considered by 7 of the 14 papers), their (4) consistency checked (disregarded by 7 of the 14 selected papers), to (5) decide the business competitive strategy, and aligned to this, (6) define the operational competitive strategies to support business

strategy. Suggestions of medium/low managers and staff can help to guide and improve the (7) action plan of operations, made to support the operations strategy on the shop floor and (8) its execution.

According to the (9) results that can be measured by: profits, productivity, quality, service, return on investment (Heikkurinen and Bonnedahl, 2013) and others, they must be (10) checked (not examined by 10 of the 14 selected papers). If the results were considered satisfactory, the (11) business performance is reached, otherwise, this research proposes four levels of analysis to achieve the objective results, different from classical studies (Skinner, 1969), going only to a superior level of analysis if the cause of the

unsatisfactory risk is not found in the level analyzed: (1st) check if the (8) execution of the plan of operations was appropriate and well-conducted, if it was, (2nd) study if the (6) action plan of operations was convenient, if it was, (3rd) analyze if the (6) operational competitive strategy was well suited and aligned with business strategy, and only in the last case, (4th) reconsider all the process of strategy formulation (1, 2 and 3) again, restarting all the process.

It should be noted the small amount of the scientific papers that addressed the strategy formulation process in sustainability; this study found 6% of the papers analyzed dealing with the theme (many times unintentionally), which reinforces the scarcity of these studies. This research strengthened that strategy formulation on sustainability by specific methods may contain biases with some proposed strategy formulation models that could generate problems (Destatte, 2010), which may be one of the reasons why there is also difficulty in transferring to the reality of the companies the intense discussion on the theme strategy on sustainability (Baumgartner and Zielowski, 2007).

The results suggested that the strategy formulation process of the studied papers could generate biases that would endanger the formulation of the sustainability strategy and compromise its implementation. The CAC-S model with environmental sustainable development concerns, incorporating important points of analysis of these 14 papers to the CAC model, appears to be consistent to formulate a strategy on environmental sustainability in relation to the ten perspectives *per se*, summarized in Table 1, given the breadth and coherence of its approach, a contribution of this study.

5. Conclusions

Based on 231 papers that studied strategy on environmental sustainability, this study selected 14, which presented a strategy formulation process in sustainability. These papers were based on ten different strategy perspectives, which were compared with the competitive strategy formulation process of CAC. The reduced number of papers selected - 6% of the total - and the difficulty in establishing a basis of comparison, pointed the scarcity of researches in this area.

By identifying 10 strategy perspectives used in the 14 selected papers, this study provided evidences that there are so many initiatives related to sustainable environmental development that could lead to confusion in those responsible for formulating and implementing the environmental sustainability strategy. The results revealed that the procedures used in the 14 selected papers did not take into account one or more important factors of the strategy formulation (as presented in Table 3), possibly generating strategy formulation on sustainable environmental development with biases that could threaten the strategy and the results, with undesirable consequences for the companies that could adopt it.

The present paper reinforced that studies on strategy formulation on sustainability by specific methods may contain biases with some models of strategy formulation proposed that could generate problems; and although the intense discussion on strategy on sustainability, there is little chance of moving it to the reality of the companies.

Incorporating important factor of analysis present in these 14 papers to the CAC strategy formulation model, due to the flexibility of the CAC model, this study proposed CAC-S, presented in Fig. 2, a basic model to formulate strategy for companies that compete pursuing the sustainable environmental development.

CAC-S is different from models that look for unsatisfactory results directly in the analysis of the competitive context, such as: market, customers, competitors and others. CAC-S emphasizes the importance of the operation strategy to be in alignment with

business strategy, and reinforces the importance of the operations to the business performance. The analysis of unsatisfactory results in different levels, starting from the operational level to the top managers (bottom-up), creates involvement of the operations with the business performance, and at the same time awaken the interest of the whole company to the operational and business strategy, what is positive to the alignment that must have between these strategies.

Companies that intend to use CAC-S must be alerted that the model supposes a permanent dialog between operations and business, with the natural suggestions and criticisms of both sides, and to the necessity of making business and operational strategy transparent at some level. The differentiation between the factors that influence business and/or operational strategy (Fig. 2) in the analysis of the competitive context is indicative and can vary accordingly to each specific company. Other factors of analysis can be added to the model or replaced, as the model is flexible and able to adapt to specific situations, a contribution of this research.

One limitation of this study was the base of comparison using 14 studies that did not focused exclusively on strategy formulation, which may have led some papers not to consider relevant factors for the strategy formulation on sustainable environmental development, as CAC did. Other limitation was the lack of empirical research using CAC for the strategy formulation and implementation on environmental sustainability, for being a relatively new model and still little known.

For future researches the present paper suggests the empirical use of CAC-S to guide the strategy formulation process and to compare CAC-S with previous models, measuring flexibility, breadth and coherence of each model; another suggestion is the involvement of the staff with strategy and its repercussion on the results.

This research hopes to arouse the interest of the academic and business community for the need to adopt appropriate strategy models and perspectives, guiding those who understand the need of producing goods and services with reduced environmental impact in the strategy formulation process.

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References

- Åhman, H., 2013. Social sustainability – society at the intersection of development and maintenance. *Local Environ.* 18 (10), 1153–1166.
- Akgün, A.A., Van Leeuwen, E., Nijkamp, P., 2012. A multi-actor multi-criteria scenario analysis of regional sustainable resource policy. *Ecol. Econ.* 78, 19–28.
- AlFaris, F., Juaidi, A., Manzano-Agugliaro, F., 2016. Improvement of efficiency through an energy management program as a sustainable practice in schools. *J. Clean. Prod.* 135, 794–805.
- Almeida, C.M.V.B., Agostinho, F., Giannetti, B.F., Huisingh, D., 2015. Integrating cleaner production into sustainability strategies: an introduction to this special volume. *J. Clean. Prod.* 96, 1–9.
- Amate, J.L., De Molina, M.G., 2013. 'Sustainable de-growth' in agriculture and food: an agro-ecological perspective on Spain's agri-food system (year 2000). *J. Clean. Prod.* 38, 27–35.
- Anityasari, M., Rachmat, A.N., 2015. Lesson learnt from top-down selection of medium enterprises for green industry pilot project in Surabaya. *Procedia Manuf.* 4, 54–61.
- Aragón-Correa, J.A., Sharma, S., 2003. A contingent resource-based view of proactive corporate environmental strategy. *Acad. Manag. Rev.* 28 (1), 71–88.
- Bansal, T., Desjardine, M., 2015. Don't confuse sustainability with CSR. *Ivey Bus. J.* 1–3.
- Barney, J., 1991. Firm resources and sustained competitive advantage. *J. Manag.* 17 (1), 99–120.

- Baumgartner, R.J., Engert, S., 2016. Corporate sustainability strategy - bridging the gap between formulation and implementation. *J. Clean. Prod.* 113, 822–834.
- Baumgartner, R.J., Rauter, R., 2017. Strategic perspectives of corporate sustainability management to develop a sustainable organization. *J. Clean. Prod.* 140 (1), 81–92.
- Baumgartner, R.J., Zielowski, C., 2007. Analyzing zero emission strategies regarding impact on organizational culture and contribution to sustainable development. *J. Clean. Prod.* 15, 1321–1327.
- Bocken, N.M.P., Fil, A., Prabhu, J., 2016. Scaling up social businesses in developing markets. *J. Clean. Prod.* 139, 295–308.
- Chen, W., Chen, J., Xu, D., Liu, J., Niu, N., 2017. Assessment of the practices and contributions of China's green industry to the socio-economic development. *J. Clean. Prod.* 153, 648–656.
- Clegg, S., 2006. The bounds of rationality: power/history/imagination. *Crit. Perspect. Account.* 17, 847–863.
- Committee of Sponsoring Organizations of the Treadway Commission (COSO), 2004. Enterprise Risk Management - Integrated Framework. Executive Summary American. Institute of Certified Public Accountants, Jersey City.
- Contador, J.C., 2008. Campos e Armas da Competicao. Saint Paul, Sao Paulo.
- Crate, S.A., 2006. Investigating local definitions of sustainability in the Arctic: insights from Post-Soviet Sakha villages. *Arctic* 59 (3), 294–310.
- Creswell, J.W., 2012. Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research, fourth ed. Pearson, Boston, MA.
- Daly, H., 1990. Toward some operational principles of sustainable development. *Ecol. Econ.* 2 (1), 1–6.
- Destatte, P., 2010. Foresight: a major tool in tackling sustainable development. *Technol. Forecast. Soc. 77*, 1575–1587.
- Drew, S., 1999. Building knowledge management into strategy: making sense of a new perspective. *Long. Range Plan.* 32 (1), 130–136.
- Eisenhardt, K.M., Martin, J.A., 2000. Dynamic capabilities: what are they? *Strat. Manag. J.* 21, 1105–1121.
- Egels-Zanden, N., Rosen, M., 2015. Sustainable strategy formation at a Swedish industrial company: bridging the strategy-as-practice and sustainability gap. *J. Clean. Prod.* 96, 139–147.
- Elkington, J., 2004. Enter the triple bottom line. In: Henriques, A., Richardson, J. (Eds.), *The Triple Bottom Line, Does it All Add up? Assessing the Sustainability of Business and CSR*. Earthscan, London, pp. 1–16.
- Forrester, J.W., 1971. Counterintuitive behavior of social systems. *Technol. Rev. Mass. Inst. Technol.* 1–29.
- Freeman, R.E., Reed, D.I., 1983. Stockholder and stakeholders: a new perspective on corporate governance. *Calif. Manag. Rev.* 25 (3), 88–106.
- Freeman, R.E., Evan, W.M., 1990. Corporate governance: a stakeholder interpretation. *J. Behav. Econ.* 19 (4), 337–359.
- Freeman, R.E., Liedtka, J., 1997. Stakeholder capitalism and the value chain. *Eur. Manag. J.* 15 (3), 286–296.
- Giannetti, B.F., Ogura, Y., Bonilla, S.H., Almeida, C.M.V.B., 2011a. Accounting energy flows to determine the best production model of a coffee plantation. *Energy Pol.* 39 (11), 7399–7407.
- Giannetti, B.F., Ogura, Y., Bonilla, S.H., Almeida, C.M.V.B., 2011b. Emery assessment of a coffee farm in Brazilian Cerrado considering in a broad form the environmental services, negative externalities and fair price. *Agric. Syst.* 104 (9), 679–688.
- Gond, J.-P., Grubnic, S., Herzog, C., Moon, J., 2012. Configuring management control systems: theorizing the integration of strategy and sustainability. *Manag. Account. Res.* 23 (3), 205–223.
- Hafsi, T., Thomas, H., 2005. The field of strategy: in search of a walking stick. *Eur. Manag. J.* 23 (5), 507–519.
- Hansen, J.W., Jones, J.W., 1996. A systems framework for characterizing farm sustainability. *Agric. Syst.* 51, 185–201.
- He, Z., Chen, P., Liu, H., Guo, Z., 2017. Performance measurement system and strategies for developing low-carbon logistics: a case study in China. *J. Clean. Prod.* 156, 395–405.
- Heikkurinen, P., Bonnedahl, K.J., 2013. Corporate responsibility for sustainable development: a review and conceptual comparison of market and stakeholder-oriented strategies. *J. Clean. Prod.* 43, 191–198.
- Henriques, J., Catarino, J., 2015. Sustainable value and cleaner production - research and application in 19 Portuguese SME. *J. Clean. Prod.* 96, 379–386.
- Hilsdorf, W.C., Mattos, C.A., Maciel, L.O.C., 2017. Principles of sustainability and practices in the heavy-duty vehicle industry: a study of multiple cases. *J. Clean. Prod.* 141, 1231–1239.
- Holling, C.S., 2001. Understanding the complexity of economic, ecological, and social systems. *Ecosystems* 4, 390–405.
- Holmberg, J., Robèrt, K.-H., 2000. Backcasting from non-overlapping sustainability principles a framework for strategic planning. *Int. J. Sustain. Dev. World* 7, 291–308.
- Hwang, K., 2014. Sustainability, new economics and policy: greening pathway for the auto industry. *Int. J. Technol. Manag. Sustain. Dev.* 13 (1), 3–14.
- Jarzabkowski, P., Wilson, D.C., 2006. Actionable strategy knowledge: a practice perspective. *Eur. Manag. J.* 24 (5), 348–367.
- Jarzabkowski, P., Spee, A.P., 2009. Strategy-as-practice: a review and future directions for the field. *Int. J. Manag. Rev.* 1 (1), 69–95.
- Jensen, J.A., Cobbs, J.B., Turner, B.A., 2016. Evaluating sponsorship through the lens of the resource-based view: the potential for sustained competitive advantage. *Bus. Horiz.* 59 (2), 163–173.
- Johnston, L.F., 2010. From Biophilia to Cosmophilia: the role of biological and physical sciences in promoting sustainability. *J. Stud. Relig. Nat. Cult.* 4 (1), 7–23.
- Kaplan, R., Norton, R., 2004. *Strategy Maps. Converting Intangible Assets into Tangible Outcomes*. Harvard Business School Press, Boston.
- Korhonen, J., 2007. From material flow analysis to material flow management: strategic sustainability management on a principle level. *J. Clean. Prod.* 15 (17), 1585–1595.
- Kunz, N.C., Kastle, T., Moran, C.J., 2017. Social network analysis reveals that communication gaps may prevent effective water management in the mining sector. *J. Clean. Prod.* 148, 915–922.
- Laari, S., Töyli, J., Ojala, L., 2017. Supply chain perspective on competitive strategies and green supply chain management strategies. *J. Clean. Prod.* 141, 1303–1315.
- Lana, R.A., 2011. Inteligencia competitiva: fator-chave para o sucesso das organizações no novo milênio. *Rev. Intel. Compet.* 1 (3), 305–327.
- Law, K.M.Y., Gunasekaran, A., 2012. Sustainability development in high-tech manufacturing firms in Hong Kong: motivators and readiness. *Int. J. Prod. Econ.* 137 (1), 116–125.
- Lioukas, C.S., Reuer, J.J., Zollo, M., 2016. Effects of information technology capabilities on strategic alliances: implications for the resource-based view. *J. Manag. Stud.* 53 (2), 161–183.
- Lozano, R., 2012. Towards better embedding sustainability into companies' systems: an analysis of voluntary corporate initiatives. *J. Clean. Prod.* 25, 14–26.
- Martens, M.L., Carvalho, M.M., 2016. The challenge of introducing sustainability into PapBoproject management function: multiple-case studies. *J. Clean. Prod.* 117, 29–40.
- Marshall, R., Brown, D., 2003. The strategy of sustainability: a systems perspective of environmental initiatives. *Calif. Manag. Rev.* 46 (1), 101–126.
- Meredith, J., 1993. Theory building through conceptual methods. *Int. J. Oper. Prod. Man.* 13 (5), 3–11.
- Mintzberg, H., Lampel, J., Quinn, J.B., Ghoshal, S., 2009. *O Processo da Estratégia: Conceitos, Contextos e Casos Seleccionados*, fourth ed. Bookman, Porto Alegre.
- Missimer, M., Robert, K.H., Broman, G., Sverdrup, H., 2010. Exploring the possibility of a systematic and generic approach to social sustainability. *J. Clean. Prod.* 18, 1107–1112.
- Murakami, F., Sulzbach, A., Pereira, G.M., Borchardt, M., Sellitto, M.A., 2015. How the Brazilian government can use public policies to induce recycling and still save money? *J. Clean. Prod.* 96, 94–101.
- Newman, L., 2006. Change, uncertainty, and futures of sustainable development. *Futures* 38 (5), 633–637.
- Nguyen, Q.A., Hens, L., 2015. Environmental performance of the cement industry in Vietnam: the influence of ISO 14001 certification. *J. Clean. Prod.* 96, 362–378.
- Odum, H.T., 1996. *Environmental Accounting: Emery and Environmental Decision Making*. John Wiley, New York.
- Oertwig, N., Wintrich, N.; Jochem, R., 2015. Model-based evaluation environment for sustainability. In: 12th Global Conference on Sustainable Manufacturing – Emerging Potentials 26, pp. 641–645.
- Onu, P.U., Quan, X., Xu, L., Orji, J., Onu, E., 2017. Evaluation of sustainable acid rain control options utilizing a fuzzy TOPSIS multi-criteria decision analysis model frame work. *J. Clean. Prod.* 141, 612–625.
- Pettigrew, A.M., 1977. Strategy design as a political process. *Int. Stud. Manag. Org.* 7 (2), 78–87.
- Pilouk, S., Koottatep, T., 2017. Environmental performance indicators as the key for eco-industrial parks in Thailand. *J. Clean. Prod.* 156, 614–623.
- Porter, M.E., 1996. What is strategy? *Harv. Bus. Rev.* 61–78.
- Porter, M.E., 1998. *Competitive Advantage: Creating and Sustaining Superior Performance: with a New Introduction*. The Free Press, New York, NY.
- Prapasongsa, T., Musikavong, C., Gheewala, S.H., 2017. Life cycle assessment of palm biodiesel production in Thailand: impacts from modelling choices, co-product utilization, improvement technologies, and land use change. *J. Clean. Prod.* 153, 435–447.
- Robèrt, K.-H., Schmidt-Bleek, B., Aloisi De Lardere, J., Basile, G., Jansen, J.L., Kuehr, R., Price Thomas, P., Suzuki, M., Hawken, P., Wackernagel, M., 2002. Strategic sustainable development - selection, design and synergies of applied tools. *J. Clean. Prod.* 10, 197–214.
- Sánchez, M.A., 2015. Integrating sustainability issues into project management. *J. Clean. Prod.* 96, 319–330.
- Seiffert, M.E.B., Loch, C., 2005. Systemic thinking in environmental management: support for sustainable development. *J. Clean. Prod.* 13 (12), 1197–1202.
- Simons, R., 1995. Control in an age of empowerment. *Harv. Bus. Rev.* 73 (2), 80–88.
- Skinner, W., 1969. Manufacturing - missing link in corporate strategy. *Harv. Bus. Rev.* 47 (3), 136–145.
- Song, Q., Li, J., Zeng, X., 2015. Minimizing the increasing solid waste through zero waste strategy. *J. Clean. Prod.* 104, 199–210.
- Subramaniam, N., Wahyuni, D., Cooper, B.J., Leung, P., Wines, G., 2015. Integration of carbon risks and opportunities in enterprise risk management systems: evidence from Australian firms. *J. Clean. Prod.* 96, 407–417.
- Székel, F., Knirsch, M., 2005. Responsible leadership and corporate social responsibility: metrics for sustainable performance. *Eur. Manag. J.* 23 (6), 628–647.
- Taisch, M., Stahl, B., May, G., 2015. Sustainability in manufacturing strategy deployment. *Procedia CIRP* 26, 635–640.
- Tucker, M.E., 2008. World religions, the earth charter, and sustainability. *Worldviews: global religions. Cult. Ecol.* 12, 115–128.
- Upadhyaya, Jk, Moore, G., 2012. Sustainability indicators for wastewater reuse systems and their application to two small systems in rural Victoria, Australia.

- Can. J. Civ. Eng. 39 (6), 674–688.
- Vigtil, A., Rolstadas, A., 2010. Toward sustainable manufacturing, in: IMS 2020 summer school on sustainable manufacturing, ETH. In: Proceedings of IMS 2020 Zürich, Switzerland.
- Voss, R., Quaas, M.F., Schmidt, J.O., Tahvonen, O., Lindegren, M., Möllmann, C., 2014. Assessing social – ecological trade-offs to advance ecosystem-based fisheries management. *PLoS One* 9 (9), 1–8.
- Wahyuni, D., Ratnatunga, J., 2015. Carbon strategies and management practices in an uncertain carbonomic environment – lessons learned from the coal-face. *J. Clean. Prod.* 96, 397–406.
- Whittington, R., 1996. Strategy as practice. *Long. Range Plan.* 29 (5), 731–735.
- World Commission on Environment and Development (WCED), 1987. *Our Common Future*. Oxford University Press, Oxford, p. 41.
- Wolff, E., Schwabe, W.K., Conceicao, S.V., 2015. Utilization of water treatment plant sludge in structural ceramics. *J. Clean. Prod.* 96, 282–289.
- Xu, R., Xu, L., Xu, B., 2017. Assessing CO₂ emissions in China's iron and steel industry: evidence from quantile regression approach. *J. Clean. Prod.* 152, 259–270.
- Zaccarelli, S.B., 2000. *Estratégia e Sucesso nas Empresas*. Saraiva, Sao Paulo.
- Zamorano, M., Grindlay, A., Molero, E., Rodríguez, M.I., 2011. Diagnosis and proposals for waste management in industrial areas in the service sector: case study in the metropolitan area of Granada (Spain). *J. Clean. Prod.* 19, 1946–1955.
- Zhang, J., Liu, Y., Chang, Y., Zhang, L., 2017. Industrial eco-efficiency in China: a provincial quantification using three-stage data envelopment analysis. *J. Clean. Prod.* 143, 238–249.