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Transition towards sustainable development in the production process of FMCG-corporates.

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BSc thesis Business and Consumer studies

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Abstract

The traditional linear production process of Fast-Moving Consumer Goods (FMCG) corporates results in depletion of natural resources, waste and pollution. As a result, the linear production process causes a negative impact on the environment. Furthermore, the availability and thus access to natural resources is limited, whereas the demand for FMCG is increasing. Combing these two reasons necessitates a transition towards sustainable development in the production process of FMCG corporates. A circular design of the production process aims to eliminate the concept of waste by creating cycles of materials without or by minimising quality loss. Maintaining the quality of material implies less usages of natural resources and less waste. Thus, a smaller negative environmental impact in comparison with the linear production process. Therefore, a circular design can be regarded as an alternative for the linear production process to provide sustainable development (SD) in the production process. Nowadays, corporates pay increasingly attention towards SD and a circular design of the production process. Nevertheless, overall, only a few researches have investigated the implementation and aspiration of a circular design of the production process.

To contribute filling this gap, this thesis will indicate the transition towards SD in the production process of FMCG-corporates by the following research question: *"Which principles regarding the transition towards sustainable development have been implemented and/or are aspired in the production process of FMCG-corporates?"* First, circular economy (C.E.) is defined most applicable school of thought to facilitate the transition towards SD in the production process of FMCG-corporates. The principles of C.E. are gathered by a systematic literature review. These principles are operationalised into indicators. Subsequently, the annual and sustainability-related reports of four FMCG-corporates in the Food & Beverage sector are manually analysed using the indicators.

Resulting from the analysis, the following conclusion can be drawn. First, a lot of indicators have not been specifically reported on the production process. Therefore, it is difficult to draw a conclusion on the implemented and aspired principles in the production process of FMCG-corporates. Second, the following principles have been implemented in the FMCG-corporates: reduce, recycle, recover, eco-efficiency and renewable resources. The principles regenerative, restorative, renewable energy and elimination of waste have not been entirely implemented in the production process of any corporate. However, relevant progress on the implementation of these principles have been realised. Therefore, the implementation of these principles has been defined as questionable. Third, aspired principles are: reduce, reuse, recycle, renewable energy, elimination of all waste and eco-efficiency. The aspiration of the principle restorative is defined as questionable

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1. Introduction

This study is a BSc thesis, written as part of the Bachelor Business and Consumer studies with the major management at Wageningen University. The first section, the introductory section, is structured as follows. First, the research background and problem analysis are discussed. Second, the definitions of the key concepts are provided. Third, the research question and structure of this thesis are presented.

1.1 Background and problem analysis

Nowadays, sustainable development is an important subject in politics, society and companies. To achieve the transition towards sustainable development, the involvement of these three parties is required (UN, 2015). In 1987 the World Commission on Environment and Development (WCED) published a report *'Our Common Future'* where they defined sustainable development (hereafter: SD) as "*a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development; and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations"* (WCED, 1987). The report has been an important trigger for the awareness of SD (Murray, Skene, & Haynes, 2017).

However, the transition towards SD is challenging for at least two reasons. First, the world population is increasing: in 2030 the world population is estimated to be 8.55 billion people. This implies an increase of more than one billion people in 15 years (Statista, 10-3-2018). Second, overall, maintaining economic growth has priority in all countries (UN, 2015). Economic growth is measured in terms of change in Gross Domestic Product, which doesn't take the non-financial negative impacts on the environment or society into account (Velenturf & Jopson, 2019). Combining these two reasons makes one expect that the demand for goods will increase, whereas negative societal and environmental impacts remain unaccounted for. Therefore, it is questionable whether these challenges will or will not oppose the transition towards SD (Kopnina, 2015).

Nevertheless, the involvement of companies towards environmental SD is necessary for at least three reasons. First, the traditional linear production process relies on the principle of take-make-use-dispose and leads to waste, pollution and removal of natural resources (Goyal, Esposito, & Kapoor, 2018; Koeijer, Wever, & Henseler, 2017; Urbinati, Chiaroni, & Chiesa, 2017). Second, natural resources are scarce which implies that their availability and thus access is limited (Goyal et al., 2018). In 2030, one expects the demand for natural resources to be larger than the amount of natural resources two earths would be able to provide (Esposito, Tse, & Soufani, 2017). Companies in general face the limitation of availability as their inputs consist foremost of natural resources. Third, the use of natural resources in production harms the environment in two ways: the reduction of the value of the resources leads to pollution and the resources are removed from the environment (Murray et al., 2017). Waste and the depletion of natural resources lead to various treats for the environment such as the greenhouse effect. The greenhouse effect causes global warming, resulting in a rising sea level, a threat for the biodiversity and a higher risk of natural disasters (UN, 1987). Thus, companies are forced by the limitation of availability and thus limited access of natural resources and environmental concerns to change their linear production process. A circular design of the production process operates from the intention to eliminate waste and to maintain the quality of material. Therefore, a circular design can be regarded as an alternative for the linear design to provide sustainable development (SD) in the production process (Koeijer et al., 2017).

An important step towards SD is transition in the production processes of the Fast-Moving Consumer Goods (hereafter: FMCG) industry for at least four reasons. First, the increase in world population will result in an increasing demand for consumer goods. A consumer in a developed country buys almost 1000-kilogram (including package) worth of consumer goods per year (Ellen-MacArthur-Foundation, 2013b). Besides, one expects an increase of middle-class consumers in the Asia-Pacific region. This will cause a rising demand for processed consumer goods, resulting in extra packaging waste (Ellen-MacArthur-Foundation, 2013b). Second, in 2012 FMCG accounted for 35% of material inputs in the economy and 75% of municipal solid waste. FMCG are goods which are frequently bought and have a short lifespan, thus not all consumer goods are FMCG. Third, in 2020, one expects the global spending on consumer goods and services to be $40 trillion, an increase of 43% ($12 trillion) compared to 2010 (A.T.Kearney, 2012). The main FMCG product categories are Food & Beverage, Household Goods & Textiles, Packaging and Personal Care & Household Products (Stewart & Niero, 2018). The product category Food & Beverage is expected to be the largest contributor of all FMCG product categories to the increased global spending, namely 13% of $12 trillion (A.T.Kearney, 2012). Fourth, in 2017, the total amount of sales of the 100 largest corporates in the Food & Beverage sector added up to roughly $1,2 trillion (Clere, 2018). Combining these four reasons directly causes rising sales of FMCG. This will result in an increased demand for natural resources, more waste and pollution, thus a larger negative impact on the environment. Therefore, transition towards SD in the production process of FMCG-corporates will result in a smaller negative environmental impact in comparison with the linear production process. There are multiple schools of thought which are applicable to facilitate a circular design of the production process (Geisendorf & Pietrulla, 2018). These schools of thought and corresponding principles will be discussed in-depth in section 2. The transformation of the linear production process to a circular design has increasingly attracted attention from corporates (Lewandowski, 2016). However, research on the implementation and aspiration of a circular design of the production process is limited (Stewart & Niero, 2018).

To contribute to filling this gap, this thesis will indicate the implementation and aspiration of the principles of the most applicable school of thought. These principles are regarded as applicable to facilitate the transition towards environmental SD in the production of FMCG-corporates in the Food & Beverage sector. Corporates present their aspirations for upcoming years and realised results so far in annual or sustainability-related reports. Thus, including both the implemented and aspired principles results in an indication of the realised transition and in the indication of the transition which is aspired to be achieved in the upcoming years in FMCG-corporates.

1.2 Key concepts and definitions

Applicable: *"affecting or relating to someone or something*" (Cambridge-Dictionary, 1-12-2019). In this thesis, the success criteria suitable, acceptable and feasible (Johnson, Scholes, & Whittington, 2005) are applied to define the most applicable school of thought.

School of thought*:* *"a set of ideas or opinions that a group of people share about a matter "* (Cambridge-Dictionary, 1-12-2019). A school of thought consists of multiple principles.

Principle: *"a basic idea or rule that explains or controls how something happens or works"* (Cambridge-Dictionary, 1-12-2019). For instance, recycle, eco-efficiency and elimination of waste are principles of a school of though. However, a principle is not yet measurable.

Indicator: *"something that shows what a situation is like"* (Cambridge-Dictionary, 1-12-2019). A principle is operationalised into an indicator. An indicator is measurable. For instance, the reduced water usage in the production process measured in a percentage.

1.3 Research question

Resulting from the background and problem analysis, the following research question is formulated:
Which principles regarding the transition towards sustainable development have been implemented and/or are aspired in the production process of FMCG-corporates?

To answer this question the following sub questions are discussed in the respective sections:
Which schools of thought are applicable to facilitate the transition towards SD in the production process of FMCG-corporates and what is the most applicable school of thought?
Section two presents a literature review which discusses applicable schools of thought to facilitate the transition towards SD in the production process. The schools of thought are discussed in-depth on their suitability, acceptability and feasibility (Johnson et al., 2005). This section closes with the school of thought which is the most applicable to facilitate this transition.

What are the indicators and dataset to indicate the transition towards sustainable development in the production process of FMCG-corporates?
Section three presents the methodology to provide an answer to the research question. First, a systematic literature review is conducted to gather the relevant articles. The relevant articles will define the principles of the most applicable school of thought. Then, the principles are operationalised into indicators on basis of the articles or by deriving the indicator from the principle. Second, the study object and corresponding dataset are specified. Third, the procedure adopted for analysing the results is explained.

Which indicators are implemented and/or aspired in the FMCG-corporates?
Section four presents the results. First, the credibility of the dataset of a corporate is evaluated by a checklist to prevent greenwashing. Second, the results of the analysis are obtained by manually analysing the dataset using the indicators. Third, the results of the analysis are compared to the CDP scores. This comparison will indicate whether the CDP scores are in line with the obtained results.

This thesis closes with the conclusion and discussion which are presented in section five. The conclusion will provide an answer to the research question.

2. Literature review

This section presents and compares schools of thought which are applicable to facilitate the transition towards SD in the production process of FMCG-corporates. The aim of this section is to answer the following sub question: *"Which schools of thought are applicable to facilitate the transition towards SD in the production process of FMCG-corporates and what is the most applicable school of thought?"* First, the necessity to transform the linear production process is discussed. Second, applicable schools of thought which can provide a circular design of the production process are presented. Third, the schools of thought are compared on the basis of suitability, acceptability and feasibility to conclude with the most applicable school of thought.

2.1 Transformation of the linear production process

The imbalance between the in- and output in the linear production process causes a finite system (Koeijer et al., 2017) and results in depletion of natural resources and negative external effects (Cong, Zhao, & Sutherland, 2017). Furthermore, the availability and thus access of natural resources are scarce as discussed in subsection 1.1. These two reasons necessitate a transformation of the linear production process. The design of a circular production process aims to eliminate the concept of waste by creating cycles of materials without or by minimising quality loss. All materials are reused as long as possible and all waste is used to create value. A circular design of material results in less depletion of natural resources, less waste and less pollution which is otherwise caused by the reduction of the value (Lieder & Rashid, 2016). Thus, a smaller negative impact on the environment. Therefore, a circular design of the production process can be regarded as a way to provide SD in a production process.

This thesis is focused on a circular design of the production process in FMCG-corporates since this will contribute to the transition towards SD. The following schools of thought can provide a circular design of the production process: biomimicry, reverse logistics, industrial ecology, blue economy, closed supply chains, cradle to cradle and circular economy (Geisendorf & Pietrulla, 2018). The schools of thought reverse logistics and closed supply chain are especially focused on optimizing the logistic process. They are applicable to provide a circular design of the production process. However, these schools of thought do not discuss, or not as deep as the others, the use of inputs and materials, the origin of inputs, the management of waste and the preferred source of energy. Therefore, closed supply chains and reverse logistic are disregarded in advance as optimal schools of thought.

2.2 The schools of thought

This subsection presents the key principles of the following schools of thought: biomimicry, industrial ecology, blue economy, cradle to cradle and circular economy. The schools of thought are sometimes interchangeable used (Geisendorf & Pietrulla, 2018). To ensure clarity, the definition of the original author is used if known. The implications on the production process of the individual schools of thought are presented in table 1.

Biomimicry

The three key principles of biomimicry are; first, the natural system is regarded as role model. Second, nature is used as principle. Nature knows what last because of 3.8-million-year experience. Third, nature is a mentor, one should learn from nature instead of extracting resources from it. Besides, nature operates between the limits of capacity and availability (Benyus, 2002).

Industrial ecology

Industrial ecology relies on the following key principles; first, the biological system is regarded as foundation of all principles. Second, the loss of material is regarded as unavoidable and recycling leads to waste and harmful by-products. Third, the usage of materials and energy is optimised and waste is minimised (Frosch & Gallopoulos, 1989).

Blue economy

The purpose of blue economy is simplicity, using what one already has and what nature does. The intention is to make sustainability affordable for consumers and profitable for producers. Blue economy relies on the following key principles; first, all systems are based on the natural ecosystem. Second, the laws of physics are applied. For instance, black and white respectively absorb and reflects the heat of the sun. Thus, a black and white striped building can operate as natural ventilation system instead of using energy. Third, materials which are hardly or not valued by others are used and all waste is used as input or as source of energy (Pauli, 2-11-2018, 2009)

C2C

C2C relies on three key principles; first, a distinction is made between products on basis of nutrients. *"Products of consumption"* are packages and FMCG products. They are solely composed of biological nutrients, non-toxic, preferable beneficial. Therefore, they can safely be decomposed or used as fertilizer to bring them back to the biosphere resulting in enrichment of the ecosystem. *"Products of services*" are products solely composed of technical nutrients. They are not suitable for the biosphere and should be reused in a closed system (Ellen-MacArthur-Foundation, 2013a). A separate cycle of technical nutrients enables to retain the high quality of materials. *"Unmarketable products"* are products which can't be environmental friendly produced, thus toxic material or hazardous waste, and should be replaced (Braungart, 16-10-2018; McDonough & Braungart, 2008b). Second, waste should, metaphorically, equal food. Third, there is alignment with the local culture, environment and economy (McDonough & Braungart, 2008a, 2008b; McDonough, Braungart, Anastas, & Zimmerman, 2003).

C.E.

Circular economy (hereafter: C.E.) provides an alternative for the linear production process (Ghisellini, Cialani, & Ulgiati, 2016; Ness, 2008). The roots of C.E. are not clear, there is argued that they can be found in related schools of thought like C2C, industrial ecology, regenerative design, performance economy, natural capital, blue economy and biomimicry (Ellen-MacArthur-Foundation, 2013a). The various definitions and interpretations of C.E. cause ambiguity of the exact definition and key principles (Kirchherr, Reike, & Hekkert, 2017; Lieder & Rashid, 2016; Reike, Vermeulen, & Witjes, 2018). The definitions of The Ellen MacArthur Foundation (hereafter: EMF) and the European Commission (hereafter: EU Commission) are often used in research (Geisendorf & Pietrulla, 2018). Therefore, these schools of thought are compared to provide the provisional key principles of C.E.. EMF is global thought leader on C.E., their mission is to "*accelerate the transition to a circular economy*" (Ellen-MacArthur-Foundation, 3-10-2018).

"*A circular economy is one that is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times, distinguishing between technical and biological cycles*" (Ellen-MacArthur-Foundation, 2013a).

"In a circular economy the value of products and materials is maintained for as long as possible; waste and resource use are minimised, and resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value" (European-Commission, 2015).

The two definitions are contradictory about the management of waste and the quality of materials. The definition of the EU Commission implies to minimise waste, whereas the definition of EMF implies to eliminate all waste (Geisendorf & Pietrulla, 2018). Besides, there is ambiguity on the quality of materials: the quality of materials is supposed to be maintained or down cycled. This thesis continues using the C.E. definition of EMF for the following arguments. First, the definition of EMF has a higher contribution towards SD: maintaining the quality of material at all times implies less usages of natural resources in comparison with down cycling. The reduction of the value of natural resources results in pollution and damage to environment as discussed in section 1.1. If the quality of material is maintained this will result in less usage of natural resources, thus a lower negative impact on the environment (Esposito et al., 2017). Second, the distinction between the biological and technical cycle is an important aspect of circular economy. This distinction is not explicitly recognized in the definition of EU Commission. Third, EMF has been established to accelerate the transition towards a circular economy and published a report concerning the opportunities of C.E. in the FMCG sector. The assumption is made that the C.E. definition of EMF has been developed to be applicable to the production process in FMCG-corporates. Therefore, this thesis provisional continues using the C.E. definition of EMF.

The key principles of C.E. as defined by EMF are: first, a division is made between technical and biological cycles which results in *"products of consumption"* and *"products of services*" as explained above. Second, systems are regenerative and restorative of design. Third, systems should be regarded as a whole. Fourth, C.E. aims to eliminate the concept of waste and to maintain the value of products and materials without quality loss (Ellen-MacArthur-Foundation, 2013a).

Table 1. Comparison of implications in the production process

	Biomimicry (*Benyus (2002)*)	**Industrial ecology** (*Frosch et al. (1989)*)	**Blue economy** *(Pauli (2009) and Pauli (website))*	**Cradle to Cradle** (*McDonough et al. (2008), McDonough et al. (2003) and Braungart (website)*)	**Circular economy** *(The Ellen MacArthur foundation (2013))*
Circular design of the production process	Imitates natural processes. Innovations are inspired by nature and measured by ecological standards.	A different cycle for each natural resource which is foremost self-sustaining. All cycles are aligned with each other to ensure an optimal overall system.	A continuous cycle, which produces more with less input and all systems are connected.	Alignment with local culture, environment and economy. There are separated technical & biological cycles.	Alignment with environment, infrastructure and social aspects. There are technical & biological cycles, materials are reused trough the chain and regenerative and restorative of design.
Criteria for material is based on	Natural materials; inorganic and organic materials that are life-friendly and self-assemble. Thus, there are no chemical processes or materials.	Amount of energy needed for transport and production and the recyclability of material.	Little or non-valued by others, local available, respect local culture and be biodegradable in the long run.	Local availability, local needs and preferences and environmental consequences.	Purity or easy to separate and minimise comparative material.
Energy source	Solar energy	Both renewable and non-renewable	Gravity and solar energy	Local solar energy	All renewable energy
Toxic materials are	Avoided	Minimised	Avoided	Avoided	Avoided
Quality of technical material	Everything is biodegradable in long run.	Maintained as long as possible but the loss of material is unavoidable.	Everything is biodegradable in long run.	Maintained at all times.	Intention to maintain quality of materials at all times.
Waste	Everything is recycled thus there is no waste.	Waste is minimised and used as input for another processes. However, waste is unavoidable	Doesn't exist, everything is used as input.	All waste from production as well as the product at the end of its life is used as input.	Intention to eliminate waste.
Hazardous waste	Avoided.	Recycling leads to harmful by-products	Avoided.	Avoided.	Avoided.

2.3 The most applicable school of thought

Table 1 displays a comparison of the schools of thought on basis of their implications in the production process. The suitability, acceptability and feasibility (Johnson et al., 2005) of the schools of thought are evaluated to define the most applicable school of thought.

Suitability

Suitability refers to whether a school of thought addresses the current trends, environmental changes and the expectations of shareholders (Johnson et al., 2005). The school of thought should be a logic choice to be applied in the production process of FMCG-corporates. In this case, the most important circumstances are the limited availability and thus access of natural resources and environmental concerns as described in section 1. In general, shareholders and their interests are divided in three groups: 1) “market environment” with an economic interest. 2) “social/political environment” and 3) “technical environment” with interest in innovations and new technology (Johnson et al., 2005). Regarding the circumstances, industrial ecology seems to cause a smaller impact on the transition towards SD in the production process than the other schools of thought. Furthermore, the principles of biomimicry are widely interpretable. As a result, it is hard to derive measurable indicators of the principles of biomimicry. Therefore, industrial ecology and biomimicry are not regarded as a logical choice and thus disregarded as the most applicable school of thought.

Acceptability

Acceptability refers to the expected outcome of the return, risks and the stakeholder reactions (Johnson et al., 2005). The return and risks are disregarded in this case since both are not specifiable without additional information. The acceptability of the “market environment” will probably be equal for C2C, C.E and blue economy because the economic aspect is included in all three schools of thought. The “political environment “ encourages C.E.: the European Union regards the transition towards C.E. as a way to create a “sustainable competitive advantage for Europe” (European-Commission, 2015). However, overall, the “social/political environment” probably encourages C.E., C2C and blue economy. All three address environmental concerns and economic aspects. Therefore, none of C2C, blue economy and C.E. is disregarded on basis of acceptability.

Feasibility

Feasibility refers to whether it is realistic to apply a certain school of thought. The availability of competence and resources should be considered (Johnson et al., 2005). Blue economy and C2C both seem to have a larger impact on transition towards SD in the production process than C.E.. However, the ambiguity of the definition of C.E causes a broad range of different and even contradictory principles as discussed in section 2.2. This broad range of principles will enlarge the chance to indicate all implemented and aspired principles related to transition towards SD in FMCG-corporates. Furthermore, the definition of C.E. seems to be inspired by all other discussed schools of thought. Thus, the assumption is made that all principles of the other schools of thought are considered to be subsumed in the definition of C.E.. Therefore, C.E. seems to be the most feasible to be applied in the production process of FMCG-corporates.

Concluding, biomimicry, industrial ecology, blue economy, cradle to cradle and circular economy are applicable to facilitate the transition towards SD in the production process of FMCG-corporates. Nevertheless, C.E. seems to be the most applicable school of thought. C.E. scores neutral on suitability and acceptability in comparison with C2C and blue economy. However, C.E. stands out on feasibility since C.E. is inspired by all discussed schools of thought and the principles of C.E have a broad range. Therefore, this thesis continues with C.E. to indicate the implemented and aspired principles in the production process of FMCG-corporates.

Subsection 2.2 explains C.E. by means of the definition of EMF. However, the assumption is made that corporates can choose which principles of C.E. best suites their practices. This is caused by the absence of a generally agreed upon definition of C.E. To include all different principles of C.E it is necessary to conduct a systematic literature review. The systematic literature review is conducted and explained in subsection 3.1.

3. Methodology

This section discusses the method to answer the research question by the following sub question: "*What are the indicators and dataset to indicate the transition towards sustainable development in the production process of FMCG-corporates?"* First, a systematic literature review is conducted to ensure a complete overview (table 3) of all principles and operationalised indicators of C.E.. Second, the study object and the dataset are defined. Third, the procedure of analysing the results is presented.

3.1 Systematic literature review

A systematic literature review (hereafter: SLR) is necessary to be able to draw a reliable and valid conclusion on the implementation and/or aspiration of the principles of C.E.. A SLR is a transparent process to review literature to ensure a complete overview of all published documents on a specific topic (Briner & Denyer, 2012). By conducting a SLR, all documents which explicit mention the principles and indicators of C.E. can be retrieved. Including all principles and thus indicators in the methodology enables a reliable indication of the implemented and aspired principles of C.E.. The SLR is conducted in the scientific literature databases Scopus and Web of Science. To include relevant documents for this thesis, the keywords C.E. and principle are used. Furthermore, Boolean operators (OR, AND) in combination with quotation marks, parenthetical remarks and asterisks are added in the query string. The relevancy of the documents is based the following query string and criteria.

Query string: *((KEY "circular economy" OR "circular-economy" OR C.E) AND TITLE (principle* OR *definition OR indicator* OR conceptualizing)).*

Criteria: 1) The documents are limited to language: English and document type: articles and review. 2) Principles or indicators of C.E. are explicit reported. 3) Focus on micro level. 4) Applicable to the production process of FMCG-corporates.

The procedure to reach the final set of articles and reviews is demonstrated in table 2. Entering the query string in the databases and applying criteria 1 resulted in 65 articles. First, the titles of the articles and reviews have been judged to remove those which are not related to circular economy. Second, the abstract of the remaining articles and reviews has been judged using the criteria. Third, the content of the remaining articles and reviews has been judged to exclude the non-relevant articles and reviews. The set of articles and reviews is complemented by "snowballing" (Petticrew & Roberts, 2006). The references list of the seven articles has been scanned on title using the criteria and specifically on the topic of FMCG-corporates. This resulted in one relevant article, thus a final set of eight articles and reviews.

Table 2. Procedure to reach the final set of articles and reviews

Procedure	**Included**	**Excluded**	**Note**
Query string Scopus	51	-	
Query string Web of Science	66	-	Instead of KEY, TOPIC is used in query string.
Limited to English and article or review	94	23	Both databases combined. One article is excluded because title doesn't conform query string and no author.

Removing double counted articles and reviews	65	29	See appendix 1 for all references of the 65 articles.
Judging on title	42	23	On basis of criteria 2, 3 and 4.
Judging on abstract	19	23	On basis of criteria 2, 3 and 4.
Judging on content	7	12	On basis of criteria 2, 3 and 4.
“snowballing”	1	-	On basis of criteria 2, 3 and 4.
Final set of articles and studies	**8**		

While processing the results, the question was raised whether “measure” would be a better word choice to define the aspects of a school of thought. A second query string has been applied to check whether relevant articles and reviews were disregarded by the first SLR. The criteria are not adjusted.
Second query string: *((KEY "circular economy" OR “circular-economy”) AND TITLE (principle* OR *definition OR indicator* OR conceptualizing)).*
The abbreviation of C.E. is disregarded from the query string because this resulted in a lot of documents which are not related to circular economy. Excluding C.E. as search term didn’t disregard relevant documents, as keywords are never an abbreviation. The second query string resulted partly in other articles and reviews. However, a quick scan of the titles, abstracts and content demonstrated that these articles and reviews foremost discuss and present measurements to calculated realised results. This imply measurements such as the life cycle assessment, material circulation indicator, measurements to calculate zero waste or eco-efficiency and more. The objective of this thesis is to indicate the implemented and aspired principles and not to calculate achieved results. Furthermore, overall, the articles and reviews gathered by both query strings use the word “principle” to identify the key aspects of C.E.. Therefore, this thesis continues using “principle”.

3.1.1 C.E. principles

The transition towards C.E. should be understood from an economic system which operates at three levels; micro, meso and macro (Geisendorf & Pietrulla, 2018; Pauliuk, 2018). However, this thesis is focussed on the production process. Therefore, only the principles of C.E. which define the implications at production level are included in the SLR and will be discussed. First, different sets of principles and some individual principles are presented. Second, the principles which are not applicable to the production process of FMCG-corporates are disregarded and rather similar principles are merged.

The identified sets of principles

A set of principles refers to principles which are often simultaneously mentioned as the principles of C.E.. The ambiguity of the definition of C.E causes a broad range of different and even contradictory principles. For instance, zero waste and reduction of waste do not imply the same outcome. Likewise, it is not possible to maintain the quality of materials at all times and to maintain the quality as long as possible. However, all identified principles are included in this subsection to be able to draw a valid conclusion on the implementation and/or aspiration of the principles. The following five sets of CE principles are identified.

First, the 3R principle: reduce, reuse and recycle, is identified as set of principles in five out of the eight articles (Banaite & Tamošiuniene, 2016; Geisendorf & Pietrulla, 2018; Kirchherr et al., 2017; Saidani, Yannou, Leroy, Cluzel, & Kendall, 2019; Stewart & Niero, 2018) although not sufficient to cover the whole definition (Geisendorf & Pietrulla, 2018). Alternatively, the 3R principle is complemented by recover; the 4R principle which is reported in two articles (Kirchherr et al., 2017; Stewart & Niero, 2018). “Recover” is more often reported in the CSR reports of the Food & Beverage sector than “recycle” (Stewart & Niero, 2018).

Second, the principles of EMF are reported in five out of the eight articles. Materials, products and components are maintained at highest utility at all times (Saidani et al., 2019). A system should be regenerative by design (Saidani et al., 2019) and restorative by design by two loops; technical and biological nutrient loops (Franklin-Johnson, Figge, & Canning, 2016). Solely renewable energy is used (Kirchherr et al., 2017; Stewart & Niero, 2018) and all waste is used as resource thus there is zero waste (Geisendorf & Pietrulla, 2018; Kirchherr et al., 2017).

Third, the principles of the definition of the EU Commission are reported in two articles; the value of materials and products is maintained as long as possible and the usage of natural resources and the outcome of waste is minimised (Banaitė & Tamošiūnienė, 2016; Geisendorf & Pietrulla, 2018).

Fourth, the principles of C.E. as defined by the BS 8001:2017 are reported in one article only. The principles are restore, regenerate, maintain utility, maintain financial value and maintain non-financial value (Pauliuk, 2018).

Fifth, some other principles of C.E. are discussed in the eight articles. These principles are: nature as role model (Geisendorf & Pietrulla, 2018), material retention (Franklin-Johnson et al., 2016), eco-efficiency (Franklin-Johnson et al., 2016; Saidani et al., 2019), refurbishment (Banaitė & Tamošiūnienė, 2016; Figge, Thorpe, Givry, Canning, & Franklin-Johnson, 2018; Franklin-Johnson et al., 2016; Saidani et al., 2019; Stewart & Niero, 2018), remanufacturing (Banaitė & Tamošiūnienė, 2016; Figge et al., 2018; Franklin-Johnson et al., 2016; Pauliuk, 2018; Saidani et al., 2019; Stewart & Niero, 2018), repurpose (Banaitė & Tamošiūnienė, 2016; Figge et al., 2018; Saidani et al., 2019; Stewart & Niero, 2018) and renewable resources (Stewart & Niero, 2018).

Disregarded and merged principles

First, the principles which are not applicable to the production process of FMCG-corporates are disregarded. FMCG are *“products of consumption”*. These products can be composed solely of biological nutrients as discussed in subsection 2.2. Therefore, repair, refurbish, remanufacture and repurpose are principles which are not applicable to the production process of FMCG-corporates. Likewise, if a FMCG should be composed solely out of biological nutrients, the technical nutrient cycle is not applicable in the production process. Eco-efficiency is described as the impact on the environment of all the economic activities (Franklin-Johnson et al., 2016). In this context it is not specifically applicable to the FMCG production process. Therefore, the principles repair, refurbish, remanufacture, repurpose, eco-efficiency of all economic activities and technical nutrient cycle are disregarded.

Second, some rather similar principles are merged. First, the principles minimise waste and natural resources (Geisendorf & Pietrulla, 2018) are submerged by reduce. Second, the indicators of restore and regenerate (Pauliuk, 2018) are rather similar to the principles regenerative and restorative as defined by the EMF. However, the indicators are differently defined by the EMF and BS 8001:2017. Therefore, all these indicators are submerged in restorative and regenerative. Third, maintain the non-financial value and utility (Pauliuk, 2018) are submerged by maintain the quality as long as possible.

3.1.2 C.E. indicators

The principles of C.E. are operationalised into indicators which are specific and measurable. The indicators will be used to indicate whether principles or set of principles are implemented and/or aspired in the production process of FMCG-corporates. An overview of the principles, the implemented indicators and keywords are displayed in table 3. The table is explained by the following four steps.

First, some principles are applicable to multiple stages in the production process. For instance, reduce can be applied to waste, packaging, water and emission. Therefore, some principles are operationalised into multiple indicators (table 3).

Second, all principles are operationalised into an implemented and aspired indicator. This division enables to examine which principles or set of principles are relatively the most implemented in FMCG-corporates. Likewise, there can be examined which principles or set of principles are relatively the most aspired in upcoming years. The majority of the implemented indicators is derived from the articles. All implemented indicators are displayed in table 3. The aspired indicators are operationalised by whether the indicator is reported as aspiration or not.

Third, the implemented indicators will be calculated in a percentage increase/decrease. This percentage will be used to indicate the extend of the realised transition of a corporate between a certain time period. Thus, a baseline needs to be determined. In 2014, C.E. is reported in roughly 10% of 630 corporate sustainability-related reports in the FMCG industry. In 2015, this percentage increases to roughly 22%, but jumps to more than 50% in 2016 (Stewart & Niero, 2018). This indicates a large increase in the awareness and application of C.E in FMCG-corporates since 2014. Therefore, the baseline year to indicate the percentage increase/decrease is set at 2014.

Fourth, some adjustments have been applied on the basis of analysing a single annual or sustainability-related report per corporate. First, the indicator water usage has been added during the execution of the research; all the corporates treat water separately from other natural resources and highly value this aspect of sustainability. Second, Nestlé, PepsiCo and JBS use the Global Reporting Initiative (GRI) index to report sustainability (appendix 2). The GRI-index is developed to provide a fair way of reporting companies activities (Van Der Ploeg & Vanclay, 2013). Therefore, applicable indicators of that GRI-index are added as keywords in table 3 (GRI, 2011).

Table 3. Principles and indicators of the implemented principles

Sets of principles	**Principles C.E.**	**Keywords**	**Indicators of implemented principles** Percentage increased/decreased per product between 2014-17 ** Not measured in percentage	**References** (underlined: principle; *italic*: keywords; **bold:** indicator; *: indicator added after analysing reports; ^: GRI indicator)
4R	Reduce	Reduce, minimize, Minimis, prolong, extend, refuse, re (-) think, re (-) design, preserve.	Reduction of natural resources	**Banaitė et al. (2016),** Geisendorf et al. (2018), *Kirchherr et al. (2017)*, Saidani et al. (2019) and ***Stewart et al. (2018)***
		All keywords for reduce.	Reduction of used water	*
		All keywords for reduce.	Reduction of waste in	**Banaitė et al. (2016)**
		All keywords for reduce, EN16^, EN18^, GHG, CO2, greenhouse gasses.	Reduction in emission	**Banaitė et al. (2016)**
		All keywords for reduce, packaging volume, weight*.	Reduced packaging	**Stewart et al. (2018)**
	Reuse	Reuse, closing the loop, cycling, repurpose, refurbish/ repair, resources, second life, maintain.	Reused natural resources	Banaitė et al. (2016), Geisendorf et al. (2018), *Kirchherr et al. (2017)*, Saidani et al. (2019) and *Stewart et al. (2018)*
		All keywords for reuse.	Reused renewable resources	**Stewart et al. (2018)**
		All keywords for reuse.	Reused materials	**Banaitė al. (2016)**
	Recycle	Recycle, remanufacture, reusing, closing the loop, cycling.	Recycled natural resources	Banaitė et al. (2016), Geisendorf et al. (2018), *Kirchherr et al. (2017)*, Saidani et al. (2019) and ***Stewart et al. (2018)***
		Keywords for recycle, reusing, EN10^.	Recycled water	*
		Keywords for recycle, EN2^.	Recycled material	**Figge et al. (2018), Banaitė al. (2016), Stewart et al. (2018)**
		Keywords for recycle.	Recycled waste	**Kirchherr et al. (2017**
	Recover	Recover, burning, incineration, energy recover.	Waste used to recover energy	*Kirchherr et al. (2017) and* ***Stewart et al. (2018)***
		Keywords recover.	By-products used to recover energy	**Stewart et al. (2018)**

EMF	Regenerative	Regenerate, regenerative, design of regenerative system, supply chain footprint, carbon footprint * Material flow analysis (MFA) and life cycle assessment (LCA)	Supply chain footprint	Geisendorf et al. (2018), Kirchherr et al. (2017), ***Pauliuk (2018)***, Saidani et al. (2019) and *Stewart et al. (2018)*
		Closing the loop, closed loop, circular	Achievement of closed production process**	***Stewart et al. (2018)***
	Restorative	Biological cycle, biological nutrients and biological material.	Production process has a separate cycle for biological nutrients**	Geisendorf et al. (2018), Kirchherr et al. (2017), **Franklin-Johnson et al. (2016)**, Pauliuk (2018), **Stewart et al. (2018)**,
		Restorative, material flow analysis and MFA, lifetime of material.	Total restored materials, products, parts and recovery rates or lifetime of material	***Pauliuk (2018)***
	Solely renewable energy	Renewable, clean*, solar, wind, bio, biomass, thermal, geothermal, hydroelectric, steam* power, EN6^.	Solely renewable energy in production**	Kirchherr et al. (2017), **Stewart et al. (2018),**
	Waste is eliminated	Zero waste, no waste, eliminate, elimination of waste.	Achievement of zero waste in production **	Geisendorf et al. (2018), Kirchherr et al. (2017)
	Maintain quality at all times	Highest quality at all times.	Materials are retained at highest quality at all times **	**Pauliuk (2018)**, **Stewart et al. (2018)**
EU Commission	Maintain quality as long as possible	Down cycle, maintain, extend, extension, longevity, circulation, as long as possible, utility.	Number of days/months the quality of material is extended	Banaitė et al. (2016), Geisendorf et al. (2018), Stewart et al. (2018), ***Figge et al. (2018)***
BS 8001:2017	Maintain financial value	Financial value, MFCA and LCC, value reused or recycled material, value end of life	The value in $ of reused recycled material and value of end of life components	***Pauliuk (2018)***
Individual	Material retention	Material retention, longevity indicator, initial usage, refurbished usage and recycled usage.	Average time of initial usage, refurbished usage and recycled usage of a product	***Franklin-Johnson et al. (2016)***
	Eco-efficiency	(Eco-)efficient, (eco-)efficiency, optimisation, maximize, EN5^, EN6^	Decreased usage of energy	Franklin-Johnson et al. (2016), Saidani et al. (2019) and **Stewart et al. (2018)**

		Recovery, (eco-) efficiency, (eco-) efficient, optimisation, maximize.	Decreased usage of resources	***Stewart et al. (2018)***
		Water stewardship, maximize, efficient, optimisation, conserved	Decreased usage of water	*
	Renewable resources	Renewable material, renewable resources, sources*.	Renewable resources	***Stewart et al. (2018)***
	Nature as role model	Nature as role model, natural system, inspired on nature, ecosystem.	Production process is based on nature**	*Geisendorf et al. (2018)*

3.2 Data

Study object

One expects the product category Food & Beverage to be the largest contributor (13% of $12 trillion) to the increased spending on consumer goods and services, compared to other product categories (see subsection 1.1) (A.T.Kearney, 2012). Therefore, this thesis is focused on FMCG-corporates in the Food & Beverage sector. It is necessary to narrow down the scope of this BSc thesis because of restricted time. A further subset of FMCG-corporates is selected on their ranking concerning the global highest sales of the 100 largest FMCG-corporates in 2017. In total the turnover of 100 largest FMCG-corporates added up to roughly $1200 billion (Clere, 2018). Restricted time necessitates a further subset of FMCG-corporates in the Food & Beverage sector. First, the turnover of the four largest corporates added in total up to almost $245 billion, that is 20 percent of the top 100 aggregate turnover (Clere, 2018). These four corporates are: Nestlé, PepsiCo, Anheuser-Busch InBev and JBS. Second, the four corporates jointly represent a broad range of product categories. Nestlé produces a broad range of food and beverage products such as baby food, drinks, coffee, chocolate, cereals and dairy. PepsiCo produces (healthier) snacks, cereals and foremost (soft) drinks. Anheuser-Busch InBev (hereafter: AB InBev) produces different beers like Corona, Jupiler, Leffe, Budweiser, Beck's and many more. JBS produces margarine, sauces, beans, ready to eat meals and foremost all kind of meat. Combining these arguments, this subset is considered representative for the Food & Beverage sector of the FMCG industry.

Table 4. Overview of sales of four largest Food & Beverage corporates

Corporate	**Total sales in 2017 ($ billion)**	**Food sales in 2017 ($ billion)**
Nestlé	$91.6	$78.9
PepsiCo	$63.5	$63.5
Anheuser-Busch InBev	$56.4	$56.4
JBS	$49.1	$46.2
		Based on: (Clere, 2018)

Dataset

The primary dataset consists of the annual and sustainability-related reports of the four corporates published on 2014, 2015, 2016 and 2017 (table 5). The year 2014 is determined as baseline as discussed in subsection 3.1. This results in a dataset of in total eight annual reports, eight combined reports and eleven sustainability-related reports.

Table 5. Overview of annual and sustainability-related reports

	Nestlé	PepsiCo	AB InBev	JBS
2014	Annual Report Nestlé in Society	Annual Report Sustainability Report GRI Report	Annual Report	Annual and Sustainability Report
2015	Annual Review Nestlé in Society	Annual Report Sustainability Report and 2025 Agenda GRI Report	Annual Report	Annual and Sustainability Report
2016	Annual Review Nestlé in Society	Annual Report Sustainability Report	Annual Report	Annual and Sustainability Report
2017	Annual Review Creating shared value	Annual Report Sustainability Report Performance with Purpose Metrics Sheet	Annual Report	Annual and Sustainability Report

However, a dataset solely composed of annual and sustainability-related reports can be vulnerable for greenwashing (Mahoney, Thorne, Cecil, & LaGore, 2013). Greenwashing refers to the process of conscious reporting a more positive image of environmental or social information than actual achieved (Van Der Ploeg & Vanclay, 2013; Wolniak, 2015). For instance by 1) intentionally disregarding certain issues from a report, 2) including false data, 3) not including the impact of the product life cycle of a product or by 4) deliberately using vague and general words to mislead the reader (Wolniak, 2015). To discourage greenwashing, several social organisations are tracking the practices of corporates (Wolniak, 2015).

The primary dataset is complemented by data from independent sources to prevent the results of the analysis of greenwashing (figure 1). First, the *"Sustainability Reporting Assessment Checklist"* (Van Der Ploeg & Vanclay, 2013) is applied per corporate to evaluate the creditability of the annual and sustainability-related reports. The checklist is developed to be able to evaluate the credibility of sustainability-related reports as stakeholder or reader (Van Der Ploeg & Vanclay, 2013). The checklist is displayed in appendix 3. Second, the results of the analysis will be compared to the Carbon Disclosure Project (hereafter: CDP) scores. CPD is a charity who measures the environmental impact of companies, states, regions and cities worldwide. Besides, they claim to have the most complete environmental data of self-reported information worldwide. The data is submitted by the company/state/region/city themselves. Then, CDP runs an analysis to provide information and a score about climate change, water, forest and supply chain (CDP, 13-12-2018). The scores range from A to D-, where A is the highest possible score and D- the lowest score. The scores are based on criteria concerning important aspects of the topics divided in “disclosure”, “awareness”, “leadership” and “management” (CDP, 2007).

3.3 Analysis methodology

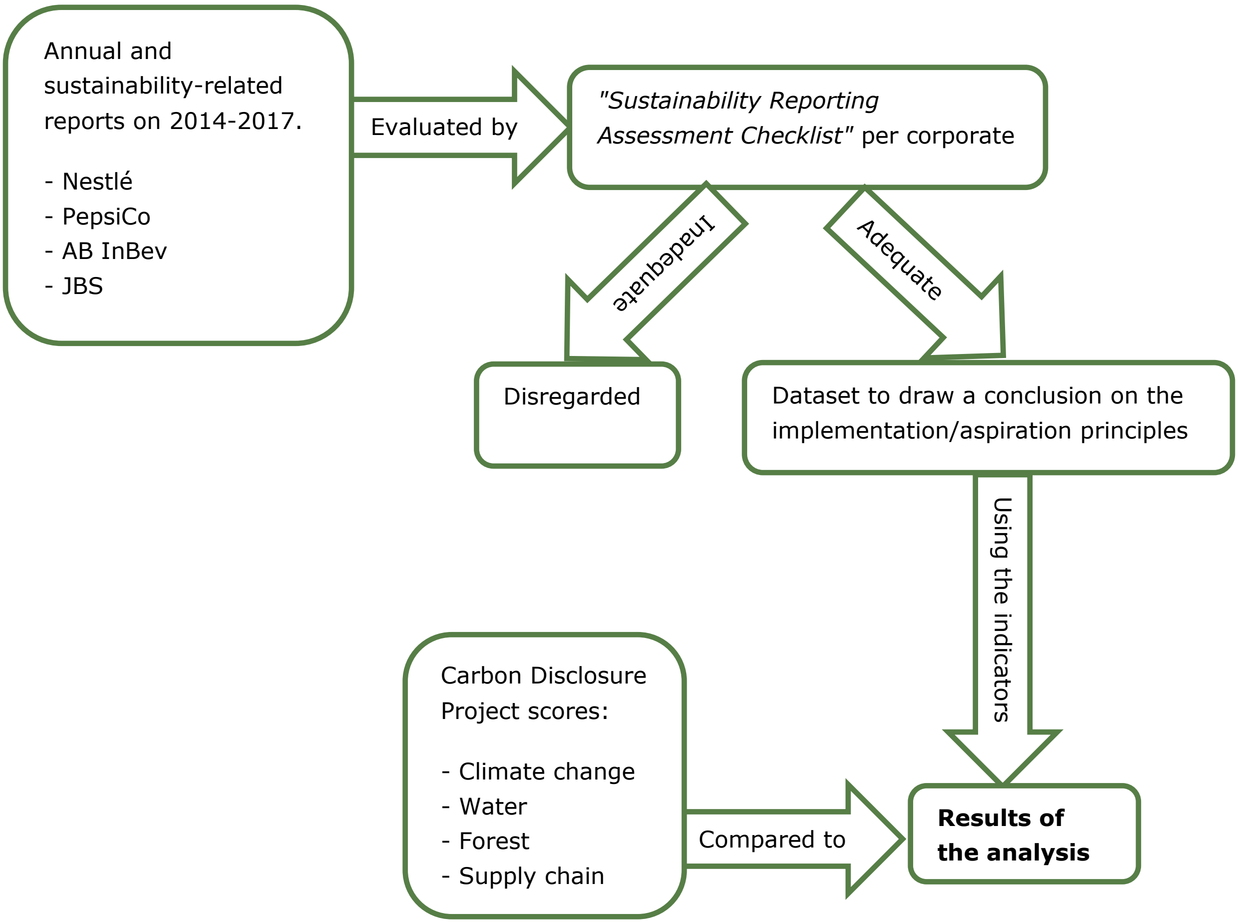
The procedure adopted for analysing the results is explained by the following three steps (figure 1).

First, per corporate the credibility of the annual and sustainability-related reports will be evaluated. The evaluation will determine whether the credibility of the dataset of a corporate is overall adequate. If the dataset of a corporate is determined as inadequate, this dataset will be disregarded to draw a conclusion on the implemented and/ or aspired principles.

Second, the dataset, if determined as adequate, will be analysed using the indicators (table 3). This analysis will result in an overview of implemented and aspired principles over the four years: the results of the analysis. The analysis of the annual and sustainability-related reports using the indicators is explained by the following five steps. First, the keywords (table 3) are entered into the search function to indicate which indicators are reported in the online annual and sustainability-related reports. Second, two requirements need to be fulfilled to define an indicator as systematically included. 1) Indicators related to the implemented principles should be explicitly reported in numbers or percentages. Likewise, the aspirations should be specifically reported as aspiration for upcoming years. 2) To be able to draw a conclusion whether a principle is implemented and to prevent to illusion of green washing, the indicator should be at least reported twice between 2014 and 2017. If these requirements are not fulfilled, the indicator and thus principle will be defined as not systematically included. Third, if possible, the percentage increase/decrease between 2014-2017 per product is calculated. The percentage increase/decrease is manually calculated by (new-old)/old * 100%. The percentage increase/decrease is not calculated if the production volume is not reported or if numbers are not reported per unit of production. This is displayed as ✓ (table 7). Fourth, in some cases the final result of 2017 will be presented instead of a percentage increase/decrease per product. This is displayed as ✓**. Fifth, some indicators correspond to each other. For instance, the reduction and eco-efficiency of water results in the same outcome: the decrease of water usages. Besides, some corporates report one general percentage concerning different principles. Both are displayed as ✓*.

In the third step of the analysis, the results of the analysis will be compared to the CDP scores to check whether the two scores are in line with each other. If the CDP scores and results of the analysis are not in line with each other, this will indicate that the credibility of the dataset need to be reconsidered.

Figure 1. The procedure of the analysis



To conclude this section, the principles are divided into implemented and aspired indicators. The applicable principles and implemented indicators are demonstrated in table 3. The aspirations will be indicated by whether an indicator is aspired or not. The primary dataset consists of the annual and sustainability-related reports on 2014, 2015, 2016 and 2017. This dataset is complemented by data from independent source to prevent greenwashing. Figure 1 displays the procedure of analysis.

4. Results

This section provides an answer to the following sub question: "*Which indicators are implemented and/or aspired in the FMCG-corporates?"* First, all results are presented. Second, the results are analysed per corporate as displayed in figure 1. Third, the results of the four individual corporates are integrated.

4.1 The results

First, the results of the evaluation of the credibility of the dataset are presented. Second, the results of the analysis are presented. Third, the CDP scores of the four corporates are presented.

Results of the credibility of the dataset

The credibility of annual and sustainability-related reports has been evaluated per corporate (table 6). The "Sustainability Reporting Assessment Checklist" (Van Der Ploeg & Vanclay, 2013) and answers are presented in appendix 3.

Table 6. Results of "Sustainability Reporting Assessment Checklist"

	Nestlé	**PepsiCo**	**AB InBev**	**JBS**
"Public availability"	Strong	Moderate	Strong	Strong
"Clear, concise and readable"	Adequate	Moderate	Moderate	Inadequate
"Use of established framework"	GRI-index	GRI-index	No	GRI-index
"Incorporation of CSR and sustainability into long-term strategy"	Adequate	Adequate	Inadequate	Moderate
"Consideration of all relevant aspects of operations"	Adequate	Adequate	Inadequate	Inadequate on global level
"Use of evidence to support claims"	Adequate	Moderate	Moderate	Inadequate
"Documented stakeholder engagement"	Inadequate	Adequate	Moderate	Adequate
"Supply chain responsibility"	Inadequate	Inadequate	Inadequate	Inadequate
"Documented impacts on all stakeholders (including vulnerable groups & negatively affected groups)"	Inadequate	Inadequate	Inadequate	Inadequate
"Assurance assessment"	Inadequate	Inadequate	Moderate	Inadequate

Based on: (Van Der Ploeg & Vanclay, 2013)

Results of the analysis

The dataset, if determined as adequate, has been analysed using the indicators. The dataset of JBS has been determined as inadequate to analyse the aspirated indicators. Therefore, the dataset of JBS has been disregarded to draw a conclusion on the aspired indicators. The results of the analysis are presented in table 7.

Table 7. Results implemented and aspired principles

Principles C.E.	**Indicators** Measured in percentage decreased/ increased per product 2014-2017	**Implemented** x: not systematically included; ✓: systematically included, no percentage available per product; Underlined ✓: implementation/aspiration is questionable; *: combined indicator; **: percentage achieved in 2017 not per product; *** percentage decreased/increased between 2014-2016.				**Aspirations** x: not systematically included; ✓: systematically included; Underlined✓: implementation/aspiration is questionable.			
References		**Nestlé** (Nestlé, 2014a, 2014b, 2015a, 2015b, 2016a, 2016b, 2017a, 2017b)	**PepsiCo** (PepsiCo, 2014a, 2014b, 2014c, 2015a, 2015b, 2015c, 2016a, 2016b, 2017a, 2017b, 2017c)	**AB InBev** (AB-InBev, 2014, 2015, 2016, 2017)	**JBS** (JBS, 2014, 2015, 2016, 2017)	**Nestlé**	**PepsiCo**	**AB InBev**	**JBS**
Reduce	Natural resources	- 7,1%***	x	x	x	x	x	x	-
	Water	- 9.5 % ***	-2% compared to 2015	-4,3%	✓	✓	✓	x	-
	Waste	-55,8% waste for disposal ***	✓	✓	✓	x	x	✓	-
	Direct GHG emission, scope 1	-11% ***	✓	✓	✓	✓	✓	✓	-
	Packaging	✓	✓	✓	✓	✓	x	x	-
Reuse	Materials	x	x	x	x	x	✓*	x	-
Recycle	Water	x	x	x	✓	x	x	x	-
	Material	x	85%** of packaging in total recycle, compostable, biodegradable	46% ** returnable or made from majority recycled content	x	x	✓*	✓	-
	Waste	x	95% *, ** recycled, recovered, reused	99,4%** of brewery waste	24,4%**	x	✓*	x	-
Recover	Waste	✓	✓* (see recycle waste)	x	-54% (0,4% **)	x	x	x	-

Regenerative	Achievement of closed production process	x	x	x	✓ (only JBS environmental)	x	x	x	-
Restorative	Production process has a separate cycle for biological nutrients.	x	✓ (see reduce, biodegradable material)	x	x	x	✓(biodeg radable material)	x	-
Renewable energy	Solely renewable energy	74,8 % (25,7 % of energy is renewable**)	x	x	17% of energy is renewable **	✓	x	✓	-
Waste is eliminated	Achievement of zero waste.	250% (253 factories**)	x	x	x	✓	✓	x	-
Eco-efficient	Energy	-7.7% ***	✓	✓	✓	x	x	x	-
	Water	✓* (see reduce)	✓* (see reduce)	✓* (see reduce)	✓* (see reduce)	✓	✓	✓	-
Renewable resources	Renewable resources	x	x	x	73,3%** in packaging JBS brazil	x	x	x	-

CDP scores

The individual CDP scores range from A to D-, where A is highest possible score and D- the lowest. CDP calculates the scores per year on four different aspects: water, climate change, forest (divided in cattle, palm oil, soy and timber) and supply chain. The scores have been retrieved from the website of CDP (CDP, 14-12-2018). The score of supply chain has never been provided for any corporate and is thus disregarded from the table.

Table 8. CDP scores

	Nestlé				**PepsiCo**				**AB InBev**				**JBS**			
Year:	**'14**	**'15**	**'16**	**'17**	**'14**	**'15**	**'16**	**'17**	**'14**	**'15**	**'16**	**'17**	**'14**	**'15**	**'16**	**'17**
Water	-	-	A-	A-	-	-	B	A-	-	A-	A-	A	-	-	A	A-
Climate change	A	A	A	A	B	B	B	A-	A	B	A-	B	C	B	A-	B
Forest	-	-	A-	A-	-	-	B-*	A-*	-	-	-	-	-	-	A-*	A/B*

*not all aspects of forest are included. Based on:(CDP, 14-12-2018)

4.2 Analysing the dataset per corporate

The results are per corporate analysed and presented. First, the credibility of the dataset has been evaluated. Second, the systematically included principles are presented. If all indicators of a principle are systematically implemented, solely the principle is presented. Third, the results of the analysis have been compared to the CDP score to see whether these scores are in line with each other.

Nestlé

First, the credibility of the dataset of Nestlé has been determined as adequate. An adequate description has been provided how SD is incorporated in the strategy. Furthermore, the majority of the indicators have been calculated thus overall, evidence is provided to the claims. However, the credibility could be improved by adding an assurance report. Besides, overall, the negative impact of their activities has not been reported. Furthermore, in 2017 it is remarkable that the outcomes of the GRI-indicators have not been reported in a separate overview. Likewise, in 2017, some numbers or percentages of indicators which were reported before, have not been included in the dataset. Therefore, the percentage increase/decrease of the principles is indicated between 2014-2016.

Second, over the four years, the following indicators have been systematically implemented in Nestlé: all indicators of reduce, recovery of waste and eco-efficiency: energy and water. The principles of renewable energy and elimination of waste have been applied. However, they do not use solely renewable energy (25,7%) and waste is not eliminated in all fabrics. Thus these principles are not entirely implemented. Nevertheless, relevant progress on the implementation of these principles has been realised. Therefore, the implementation of the principles of renewable energy and elimination are defined as questionable. The following indicators are systematically included in the dataset as aspiration: reduce: water, emissions and packaging, solely renewable energy, elimination of waste in all factories and eco-efficiency of water. In 2016, C.E. have been reported four times in the dataset.

However, no definition of C.E. has been provided (Nestlé, 2014a, 2014b, 2015a, 2015b, 2016a, 2016b, 2017a, 2017b).

Third, the CDP scores are in line with the results of the analysis. The CDP scores demonstrates that Nestlé released the highest possible score for climate change and the scores of water and forest are second-best. Therefore, there is no reason to reconsider the credibility of the results of the analysis.

PepsiCo

First, the credibility of the dataset of PepsiCo has been determined as adequate. Overall, the evidence to support a claim has been provided. The stakeholders have been identified and engaged. Furthermore, SD has been reported as being aligned with the strategy. Nevertheless, by reporting the negative impact of their activities the credibility of the dataset could be improved. Furthermore, an independent assurance report will enlarge the credibility of the dataset. In 2017, it is remarkable that the evidence to support the claims have been ambiguously reported in comparison with 2014, 2015 and 2016.

Second, over the four years, the following indicators have been systematically implemented in PepsiCo: reduce: water, waste, emissions and packaging, recycle: material and waste, recovery of waste, and eco-efficiency of water. PepsiCo reported that their packaging consists for 85% of recyclable, compostable or biodegradable material. Biodegradable can be linked to the principle of restorative. However, the principle or indicator has not been reported as realised. Therefore, the implementation of the principle restorative is defined as questionable. The following indicators are systematically included in the dataset as aspiration: reduce: water and emissions, reuse materials, recycle: materials and waste, achievement of zero waste and eco-efficiency of water. PepsiCo aspires packaging which is 100% recycle, compostable or biodegradable. However, this does not imply that the principle restorative is entirely aspirated. As a result, the aspiration of restorative is defined as questionable. The school of thought of C.E. has been once reported in both 2015 and 2016. No definition of C.E. has been provided (PepsiCo, 2014a, 2014b, 2014c, 2015a, 2015b, 2015c, 2016a, 2016b, 2017a, 2017b, 2017c).

Third, over the four years, the CDP scores positively change from a B to an A- on water, climate change and forest. Furthermore, the results of the analysis and CDP score do not indicate contradictories. Therefore, the credibility of the results of the analysis is not reconsidered.

AB InBev

First, the credibility of the dataset of AB InBev has been determined as adequate. Overall, the reported claims have been provided with evidence. In 2017, it is remarkable that more specific information has been reported in comparison with 2014, 2015 and 2016. Likewise, in 2017 an independent assurance report is added which strengthens the credibility of the dataset. Nevertheless, the credibility of the dataset could be further improved on multiple aspects. The credibility would be strengthened by addressing all sustainability issues and by reporting the positive and negative the impact of their activities.

Second, over the four years, the following indicators have been systematically implemented in AB InBev: reduce: water, waste, emissions and packaging, recycle: material and waste, and eco-efficiency of water. The following indicators are systematically included in the dataset as aspiration: reduce: water and emissions and recycle material. In 2016, C.E. has been reported once, however no definition has been provided. Furthermore, circular packaging has been reported as aspiration (AB-InBev, 2014, 2015, 2016, 2017). It is remarkable that that solely three indicators, reduce water and emissions and recycle material, are systematically included as aspiration, whereas seven indicators have been implemented over the four years.

Third, the CDP score of water demonstrates an improvement from an A- to an A between 2015 and 2017. This is in line with the results of the analysis: reduction of water is implemented and aspired in the dataset of AB InBev. Nevertheless, the CDP score of climate change has declined over the four years from an A to a B. This could imply a decrease in attention or effort to the transition towards SD. This would be in line with the results of the analysis: whereas seven indicators have been implemented, three indicators are aspired. However, the dataset is too small to draw a valid conclusion whether the effort to the transition towards SD has decreased. Therefore, the credibility of the results of the analysis are not reconsidered.

JBS

First, the credibility of the dataset of JBS to draw a conclusion on the aspiration of the principles has been determined as inadequate. JBS does not specifically report their (global) aspirations for upcoming years. As a result, the dataset of JBS is disregarded to indicate the aspired indicators. The credibility of the dataset to draw a conclusion on the implemented principles is determined as adequate. The stakeholders and their most important interests have been identified in the reports. Overall, the credibility of the dataset of JBS can be improved on multiple aspects. JBS operates at different continents and a lot of issues are reported at business unit level, not at global level. Overall, evidence to support a claim has been ambiguous presented and mistakes have been made. However, a principle should be reported as number/percentage and should be at least twice reported in different years. Therefore, the credibility to draw a conclusion on the implemented principles is regarded as adequate.

Second, over the four years, the following indicators have been systematically implemented in JBS: reduce: water, waste, emissions and packaging, recycle: water and waste, recover waste, eco-efficiency: energy and water and renewable resources. The implementation of the principles solely renewable energy and regenerative are questionable. 17% of all energy is renewable thus not solely renewable energy is used. Furthermore, JBS environmental in Brazil achieved a closed production cycle. However, one business unit is not representative for the whole corporate. Thus the principles solely renewable energy and regenerative are not entirely implemented. Nevertheless, relevant progress on the implementation of these principles have been realised. In 2014 and 2017, C.E. has been reported once. Another time, no definition of C.E. has been provided.

Third, over the four years, the CDP scores have improved. However, in 2017 the scores of water, forest and climate change have declined in comparison with the scores of 2016. This decline doesn't directly imply a contradictory with the results of the analysis. Therefore, the credibility of the dataset is not reconsidered.

4.3 Integration of the individual results

Resulting from integrating the individual results, the following six interpretations can be derived. The total amount of times an indicator has been implemented and/or aspired is presented in table 9. The dataset of JBS is disregarded to indicate the aspired principles. Therefore, an aspired indicator can be reported trice at maximum.

Table 9. Times a of implemented and aspired principles

Principles C.E.	**Indicators** Underlined: implementation/aspiration is questionable; **Bold:** the implemented or aspired indicator is reported in all corporates.	**Times a principle is implemented**	**Times a principle is aspired**
Reduce	Natural resources	1	0
	Water	**4**	2
	Waste	**4**	1
	Direct GHG emission, scope 1	**4**	**3**
	Packaging	**4**	1
Reuse	Materials	0	1
Recycle	Water	1	0
	Material	2	2
	Waste	3	1
Recover	Waste	3	0
Regenerative	Achievement of closed production process	1	0
Restorative	Production process has a separate cycle for biological nutrients	1	1
Solely renewable energy	Solely renewable energy	2	2
Waste is eliminated	Achievement of zero waste	1	2
Eco-efficient	Energy	**4**	0
	Water	**4**	**3**
Renewable resources	Renewable resources	1	0

First, the following indicators are not specifically reported on the production process of the FMCG-corporates: waste, solely renewable energy, direct GHG emissions and in some corporates water.

Second, over the four years, the corporates have relatively implemented the most indicators of reduce and eco-efficiency. Besides environmental considerations, the motivation for the implementation of reduce and eco-efficiency could be costs. Reducing or being more efficient results in less usage of resources and thus lower total costs. The following indicators are relatively the most aspired for upcoming years: eco-efficiency of water and reducing direct GHG emissions.

Third, over the four years, relatively the most indicators of the 4R principles have been implemented in comparison with the other sets of principles (see subsection 3.1.1). Although, reuse is quite often reported in the dataset, reuse has not been reported as implemented. None of the EMF principles has been implemented in the four corporates. Nevertheless, the implementation of the following principles is defined as questionable: the elimination of waste, solely renewable energy, regenerative and restorative. These principles are not entirely implemented. However, relevant progress on the implementation of these principles has been realised. Two principles of the EU Commission have been implemented. Minimising the use of natural resources has been reported once (submerged by reduce) and minimising waste (submerged by reduce) has been reported four times. The indicators of the principles of BS 8001:2017 have not been implemented. The individual principle eco-efficiency has been implemented in all four corporates. The individual principle renewable resources has been reported once as implemented.

Fourth, the 3R principle, eco-efficiency, minimise waste as defined by the EU Commission and most of the EMF principles are aspired in the four FMCG-corporates. The 3R principle is systematically included in the dataset as aspiration. Reduce is seven times reported as aspiration, recycle trice and reuse once. The EMF principles of solely renewable energy and zero waste have been twice reported as aspiration. The aspiration of the principle restorative is defined as questionable. Solely the principle reduction of waste has been reported once as aspiration, the other principles of the EU Commission have not been reported as aspiration. The indicators of the principles of BS 8001:2017 are not aspired. The individual principle eco-efficiency of energy is aspired in all three corporates. The analysis of the set of principles could demonstrate a shift in the principles to the EMF principles. The implemented principles are the 4R principle and eco-efficiency. The aspired principles are the 3R principles, eco-efficiency, reduction of waste and most of the EMF principles. It is remarkable that both the 3R principle and the principles as defined by EMF are identified as set of principles in five out of the eight articles (see subsection 3.1.1). However, the dataset is too small to draw a valid conclusion whether there is a shift to the EMF principles or not.

Fifth, the credibility of the dataset of all corporates can be improved. Over the four years, all corporates didn’t report the negative impact of their actions. The credibility of the dataset Nestlé and PepsiCo seems to be stronger than the credibility of the dataset of JBS and AB InBev. However, in 2017, the evidence to support the claims have been ambiguously presented at Nestlé and PepsiCo in comparison with 2014, 2015 and 2016. Nevertheless, the dataset is too limited to draw a conclusion whether this is a one-time event or a trend.

Sixth, all four corporates reported the school of thought of circular economy however, none of the corporates provided a definition of C.E.. In 2016, C.E. is six times reported in the dataset of the four corporates. The school of thought is once mentioned in 2014, 2015 and 2017.

To conclude this section, it is difficult to draw a conclusion on the implementation and aspiration of the principles in the production process of FMCG-corporates. The reason being that not all indicators are specifically reported on the production process of FMCG-corporates. Over the four years, the following indicators have been systematically implemented in all four corporates: reduce: water, waste, direct GHG emissions and packaging, eco-efficiency: water and energy and renewable resources. The dataset of JBS has been determined as inadequate. Therefore, the dataset of JBS has been disregarded to indicate the aspired principles. The following indicators are systematically included as aspiration in all three corporates: eco-efficiency of water and the reduction of direct GHG emissions. Table 7 presents an overview of all the indicators which are implemented and/or aspired in the corporates. Furthermore, relatively, the 4R principle is the most implemented in comparison with the other set of principles. There is no unique set of principles which is relatively the most aspired. The 3R principles and the EMF principles are aspired. Likewise, the principles minimisation of waste and eco-efficiency are aspired.

5. Conclusion

The aim of this thesis is to answer the research question: "*Which principles regarding the transition towards sustainable development have been implemented and/or are aspired in the production process of FMCG-corporates?"* First, the conclusion on the individual sub questions are presented. Second, the conclusion on the research question is presented. Third, the validity and contribution of this thesis are discussed. Fourth, the limitations and recommendations for further research are discussed.

5.1 Conclusion on the sub questions

"Which schools of thought are applicable to facilitate the transition towards SD in the production process of FMCG-corporates and what is the most applicable school of thought"

Section two demonstrates that biomimicry, industrial ecology, blue economy, cradle to cradle and circular economy are applicable schools of thought to facilitate the transition towards SD in the production process of FMCG-corporates. C.E. scores neutral on suitability and acceptability in comparison with C2C and blue economy. However, C.E. stands out on feasibility. C.E. is inspired by all discussed schools of thought and the ambiguity around the definition of the concept causes a broad range of principles. Therefore, C.E. is defined as the most applicable school of thought to facilitate the transition towards SD in the production process of FMCG-corporates.

"What are the indicators and dataset to indicate the transition towards sustainable development in the production process of FMCG-corporates"

An overview of the indicators which is used to indicate the implementation of the principles is presented in table 3. The principles of C.E. are gathered by a systematic literature review. The indicators are derived from the principles and divided into implemented and aspired indicators. The aspired indicators are indicated by whether a principle is aspired or not. The primary dataset consists of the annual and sustainable reports of Nestlé, PepsiCo, AB InBev and JSB on the years 2014, 2015, 2016 and 2017. To protect the dataset from greenwashing, the credibility of the dataset is evaluated by the "*Sustainability Reporting Assessment Checklist*" (Van Der Ploeg & Vanclay, 2013). Furthermore, the procedure to analyse the dataset using the indicators is presented. The results of the analysis are compared to the CDP scores to ensure the credibility of the results of the analysis. The dataset of JBS is determined as inadequate to indicate the aspired indicators. Therefore, the dataset of JBS is disregarded to draw a conclusion on the aspiration of the principles.

"*Which indicators are implemented and/or aspired in the FMCG-corporates?"*

Over the four years, the following indicators have been systematically implemented in the four corporates: reduce: natural resources, water, waste, direct GHG emissions and packaging, recycle: water, material and waste, recover, eco-efficiency: water and energy and renewable resources. The following indicators are systematically included as aspiration in the three corporates: reduce: water, waste, direct GHG emissions, packaging, reuse: material, recycle: material and waste, solely renewable energy, elimination of waste and eco-efficiency: water.

5.2 Conclusion on the research question

"*Which principles regarding the transition towards sustainable development have been implemented and/or are aspired in the production process of FMCG-corporates?"*

Since many indicators are not specifically reported on the production process, it is difficult to draw a conclusion on the implementation and/or aspiration of principles in the production process. Nevertheless, over the four years, the following principles have been systematically implemented in the FMCG-corporates: reduce, recycle, recover, eco-efficiency and renewable resources. The implementation of the principles regenerative, restorative, solely renewable energy and the elimination of waste are defined as questionable. These principles are not entirely implemented in the FMCG-corporates. However, relevant progress on the implementation of these principles has been realised. The following principles are aspired in the FMCG-corporates in upcoming years: reduce, reuse, recycle, solely renewable energy, elimination of waste and eco-efficiency. The principle of restorative is defined as questionable. Furthermore, relatively, the 4R principle is the most implemented in comparison with the other set of principles. The 3R principle and multiple EMF principles are aspired. Likewise, minimising waste as defined by the EU Commission and eco-efficiency are aspired in the upcoming years.

5.3 Discussion: validity and contribution

This subsection discusses the validity and contribution of this thesis. First, the absence of a general agreed upon definition of C.E. may have affected the validity. The absence of a general agreed upon definition causes ambiguity around the principles and indicators of C.E. Therefore, there is assumed that corporates can choose which principles of C.E. best suites their practices. A SLR has been conducted to gather all different principles of C.E.. Resulting in a complete overview of all principles of C.E. to ensure the validity. Second, as discussed in subsection 3.1, not including "measure" in the query string may have affected the validity. Nevertheless, a second query string is applied to indicate whether relevant articles were disregarded by the first query string. A quick scan of the titles, abstracts and contents, indicated that the articles in general contained measurements to calculated results. For instance, the measurements of the life cycle assessment and the material circulation indicator. The objective of this thesis is to indicate the implementation and aspiration of the principles and not to calculate numbers. Therefore, not including "measure" or other synonyms of principle is a not regarded as a large threat for validity. Third, greenwashing may be have affected the validity. To prevent the dataset of greenwashing, the credibility of the dataset has been evaluated by the *"Sustainability Reporting Assessment Checklist"* (Van Der Ploeg & Vanclay, 2013). The dataset of JBS has been determined as inadequate. As a result, the dataset of JBS is disregarded to draw a conclusion on the aspiration of the principles. Furthermore, the results of the analysis have been compared to the CDP scores to check whether the scores are in line. Overall, the CDP scores are in line with the results of the analysis. Therefore, the credibility of the dataset of all corporates is not reconsidered. Besides, indicators should at least be reported twice to be systematically implemented. Overall, the ambiguity of the definition of C.E., not including synonyms of principle in the query string and greenwashing may have affected the validity. However, preventive actions have been applied to ensure the validity. Therefore, overall, the validity is regarded as adequate.

It is remarkable that previous research demonstrated that “recover” was more often reported in sustainability-related reports in the Food & Beverage sector than ”recycle” (Stewart & Niero, 2018). However, this thesis (table 7) demonstrates that recover is hardly implemented in the four Food & Beverage corporates. Besides, this thesis demonstrates that none of the four corporates aspires the principle of recover in the upcoming years.

An important insight of this thesis is that over the four years, the 4R principle is relatively the most implemented in comparison with the other sets of principles (subsection 3.1.1). The 3R principle, most of the EMF principles, eco-efficiency and minimise waste are aspired in FMCG-corporates. It is remarkable that both the 3R principle and the principles as defined by EMF are identified as principles in 5 out of the eight articles whereas the other sets of principles are identified in less articles.

5.4 Discussion: Limitations and future research

This subsection discusses five limitations of this thesis followed by recommendations. First, this thesis is focussed on the production process of FMCG-corporates. Some principles are not specifically reported on the production process of the FMCG corporates (see subsection 4.2). For instance, the direct GHG emissions and the usage of solely renewable energy are not specifically reported on the activities in the production process. Therefore, it is not possible to draw a conclusion on the implementation and aspiration of the principles in the production process. Second, a small subset of four corporates in the Food & Beverage sector is selected to indicate the implementation and/or aspiration of the principles in the production of FMCG-corporates. This subset cannot be regarded as entirely representative for all FMCG-corporates and neither for all corporates in the Food & Beverage sector. Therefore, this thesis can solely be used to indicate the implemented and aspired principles in the production of FMCG-corporates. Third, the primary dataset is composed of annual and sustainability-related reports. Solely information published in these reports is used, the dataset is not complemented by additional interview or questionnaires. For future research, it would be valuable to enlarge the subset of the study object and to enlarge the dataset with quantitative and qualitative data. Fourth, it is remarkable that the reports on 2017 of both Nestlé and PepsiCo are ambiguously presented in comparison with the reports of 2014, 2015 and 2016. Nevertheless, the dataset is too limited to draw a conclusion whether this is a one-time event or a trend. Fifth, to achieve the transition towards SD, SD should be regarded from a holistic approach (Ghisellini et al., 2016). However, this thesis focuses on the environmental dimension thus disregards the societal and economic dimension.

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Appendix 2. GRI-index

Aspect	**Number**	**Meaning**
Materials	EN1	Materials used by weight or volume.
	EN2	Percentage of materials used that are recycled input materials.
Energy	EN3	Direct energy consumption by primary energy source.
	EN4	Indirect energy consumption by primary source.
	EN5	Energy saved due to conservation and efficiency improvements.
	EN6	Initiatives to provide energy-efficient or renewable energy-based products and services, and reductions in energy requirements as a result of these initiatives.
	EN7	Initiatives to reduce indirect energy consumption and reductions achieved.
Water	EN8	Total water withdrawal by source.
	EN9	EN9 Water sources significantly affected by withdrawal of water.
	EN10	Percentage and total volume of water recycled and reused.
Biodiversity	EN11	Location and size of land owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas.
	EN12	Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas.
	EN13	Habitats protected or restored.
	EN14	Strategies, current actions, and future plans for managing impacts on biodiversity.
	EN15	Number of IUCN Red List species and national conservation list species with habitats in areas affected by operations, by level of extinction risk.
Emissions, Effluents, and Waste	EN16	Total direct and indirect greenhouse gas emissions by weight.
	EN17	Other relevant indirect greenhouse gas emissions by weight.
	EN18	Initiatives to reduce greenhouse gas emissions and reductions achieved.
	EN19	Emissions of ozone-depleting substances by weight.
	EN20	NO, SO, and other significant air emissions by type and weight.
	EN21	Total water discharge by quality and destination.
	EN22	Total weight of waste by type and disposal method.
	EN23	Total number and volume of significant spills
	EN24	Weight of transported, imported, exported, or treated waste deemed hazardous under the terms of the Basel Convention Annex I, II, III, and VIII, and percentage of transported waste shipped internationally.
	EN25	Identity, size, protected status, and biodiversity value of water bodies and related habitats significantly affected by the reporting organization's discharges of water and runoff
Products and services	EN26	Initiatives to mitigate environmental impacts of products and services, and extent of impact mitigation.
	EN27	Percentage of products sold and their packaging materials that are reclaimed by category.
Compliance	EN28	Monetary value of significant fines and total number of non-monetary sanctions for noncompliance with environmental laws and regulations.
Transport	EN29	Significant environmental impacts of transporting products and other goods and materials used for the organization's operations, and transporting members of the workforce.
Overall	EN30	Total environmental protection expenditures and investments by type.

Reference: (GRI, 2011)

Appendix 3. "Sustainability Reporting Assessment Checklist"

	Nestlé	**PepsiCo**	**AB InBev**	**JBS**
Reference: (Van Der Ploeg & Vanclay, 2013)	*(Nestlé, 2014b, 2015b, 2016b, 2017b)*	*(PepsiCo, 2014a, 2014c, 2015b, 2015c, 2016b, 2017b, 2017c)*	*(AB-InBev, 2014, 2015, 2016, 2017)*	*(JBS, 2014, 2015, 2016, 2017)*
"Q1 Is the report publicly available in appropriate languages?"	English, French, German and Spanish.	English.	English, French and Dutch.	English and Brazilian.
"Q2 Is the report written in a clear and concise way and readable by relevant stakeholders?"	Yes, in 2014-2016 GRI-index published in a table. However, in 2017 more ambiguous.	Yes. However, in 2017 the report is ambiguous compared to 2014, 2015 and 2016.	Yes. Less SD issues are included however the topics which are reported are clear.	Inadequate. Some mistakes or vague whether global or continental.
"Q3 Does the company use an established reporting framework, such as the GRI?"	Yes GRI	Yes GRI	No	Yes GRI
"Q4 Is there an adequate description of how the company incorporates CSR and sustainable development into the formulation of its long-term organizational strategy?"	Yes, often reported as included in long-term strategy and in different parts. CSR is regarded as strategic tool.	Yes, often reported. Sustainable Development Goals alignment with strategy.	No, hardly reported and not demonstrated.	It is reported as important and included in strategy. However, it is not a pillar in the strategy.
"Q5 Does the company discuss the sustainability issues of all relevant aspects of its operations?"	Not all, see results	Not all, see results	No, a lot of issues are not reported. However, in 2017 more issues are reported than before.	Not all. Most issues are reported on continent of business unit. Only a few aspects are reported on global level.

“Q6 Does the company provide adequate evidence (e.g. data) to support the claims it makes in relation to all indicators and/or topics being discussed?”	Yes. Overall, number or percentages are included. However, in 2017 less evidence is provided than before.	Yes. Overall, numbers are included. However, in 2017 less evidence is provided than before.	Yes. Claim are supported by numbers or percentages.	Semi. The baseline is sometimes vague. Likewise, vague whether the numbers are reported on global results or continental results.
“Q7 Does the company identify all its stakeholders, explain how they are identified, and do they outline the expectations and interests of their stakeholders?”	Not reported as separate sheet.	Stakeholders are identified and engaged.	Stakeholders are identified.	Stakeholders and their most important interests are identified.
“Q8 Does the company assess the sustainability issues associated with all upstream and downstream entities in its supply chain?”	No	No	No	No
“Q9 Does the company adequately discuss the impacts of its activities (both positive and negative) on all its stakeholders, including vulnerable groups and negatively-affected groups?”	The negative impacts are not discussed	The negative impacts are not discussed	Not discussed at al	The negative impacts are not discussed
“Q10 How does the company establish the credibility of its sustainability report, for example is there an independent assurance report?”	No independent report.	No independent report.	Only in 2017: an assurance report of the independent Auditor.	No independent report.