

Sustainable strategies in the luxury business to increase efficiency in reducing carbon footprint

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ABSTRACT

This research aims to analyse whether a sustainable strategy brings efficiency to the luxury sector in the fight against carbon footprint. Such an aim has been approached by establishing a relationship between the actions implemented in the sector, the carbon footprint as measured by the Intergovernmental Panel on Climate Change methodology, and the market share of the main market operators. The results reveal which actions tend to be efficient in terms of carbon footprint fight, which actions do not, and how concentration or dispersion of main operators has impacted the global carbon footprint in the sector. Consequently, this work explores specific actions that luxury companies take to be economically efficient in their business strategy and to protect the environment. Finally, companies must be efficient and sustainable to contribute to the United Nations' Sustainable Development Goals outlined in the 2030 Agenda.

1. Introduction

The concepts of luxury and sustainability are related to the production of certain luxury items that entail the use of precious, unique, and high-quality materials processed to last for generations (Amatulli, De Angelis, Costabile, & Guido, 2017; Ki & Kim, 2016; Ozdamar-Ertekin, 2019; Willersdorf, Hazan, Ricci, Prénau, Bianchi, Seara, & Yang, 2020). Beyond the opportunity to differentiate itself from competition (Shashi, Centobelli, Cerchione, & Mittal, 2021), sustainability has become a fundamental pillar in the business of large luxury conglomerates in Europe, especially those dedicated to fashion (Ozdamar-Ertekin, 2019).

Luxury brands are considered the leading companies in the market (Osburg, Davies, Yoganathan, & McLeay, 2021). On the one hand, they are responsible for many of the innovations later adopted by other fast-moving consumer goods sectors (Waller, Fawcett, & Johnson, 2015). On the other hand, luxury brands—especially luxury fashion brands—strongly influence people's aspirations and behaviours. This influence justifies their key role in promoting sustainable development and the fight against climate change at the international level (Bae, 2019; Osburg et al., 2021).

From a sustainability perspective, luxury brands are a model in the

fashion industry (Choi, 2014). Researchers have found that the circular economy is a new global trend that provides opportunities for brands to offer sustainable solutions. Currently, researchers focused on sustainable luxury and study aspects, such as the supply chain, communication, and product innovation, seeing the impact of these activities on consumer behaviour (Kunz, May, & Schmidt, 2020). Consequently, luxury develops towards more ethical and environmentally friendly practises (Deloitte, 2020) and the growing expectations of the younger generations (Pencarelli, Gabbianelli, & Savelli, 2020). These generations are acutely aware of sustainability and its impact on their purchasing decisions. In fact, these consumers account for half of all global sales of luxury goods (Deloitte, 2020).

Globally, there is a growing awareness of the effects of climate change and rising greenhouse gas (GHG) emissions on the health of people and the planet (Habib, White, Hardisty, & Zhao, 2021), and the luxury industry is no exception. Hence, large luxury conglomerates are attempting to respond to the climate emergency by implementing environmentally friendly measures throughout the value chain and promoting the circular economy and recycling (Berg, Granskog, Lee, & Magnus, 2020; Thorisdottir & Johannsdottir, 2020; Willersdorf et al., 2020). This is reflected in luxury holding companies' sustainability strategies and reports, such as LVMH (2022), Kering (2022a), and

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Chanel (2022).

The study of how luxury fashion brands are becoming more sustainable while increasing their economic efficiency still needs further research because they can serve as examples for other industries and sectors (Diallo, Dahmane, Gadekar, & Schill, 2021; Osburg et al., 2021; Rukhaya, Yadav, Rose, Grover, & Bisht, 2021). Therefore, this study examines how two of the main European conglomerates of luxury fashion brands respond to one of the main challenges we face in society, such as climate change, according to Deloitte (2020).

The novelty of this work lies in the analysis of the evolution of LVMH and Chanel's carbon footprint measured by the Intergovernmental Panel on Climate Change (IPCC) methodology and their economic results over the years in which the data were available. Additionally, this study intends to detect which actions these conglomerates have conducted regarding carbon footprint reduction. The combination of both analyses could reveal a possible link between such actions and any efficiency discovered in the luxury fashion sector. To this end, this article reviews different studies related to luxury fashion brands and the concept of efficiency, and it presents an analysis of the mentioned companies to reach conclusions and discussion.

The remainder of this paper is organised as follows. First, a review has been conducted of the literature on corporate social responsibility (CSR) and sustainability in the luxury industry and how these firms manage their carbon footprint to reduce their climate change impact. Second, the methodology followed, and the data used for this analysis are described. Third, we examined the results obtained for luxury conglomerates. Finally, we discuss and summarise the conclusions and some limitations of the study.

2. Theoretical framework

2.1. How sustainability is becoming more relevant in the luxury industry

Global interest in CSR and corporate sustainability has been increasing recently in academia and companies, with a focus on measuring the impact and efficiency of activities carried out by companies. Although CSR refers to companies' voluntary social and environmental impacts, the global market now strongly requires that companies include sustainable solutions in their CSR strategy because of the impact of climate change and the consequences of the global pandemic caused by COVID-19. Thus, this situation heightens interest in CSR (Carroll, 2021) and the desire to understand how companies contribute efficiently to social and environmental problems, their measurement, and impacts (Barnett, Henriques, & Husted, 2020), as well as the need to contribute best practises in all industries.

This sense of urgency transferred to companies means that CSR activities consider social needs and the expectations of all stakeholders (Carroll & Buchholtz, 2014), with special attention paid to consumers, who have increasingly demanded more sustainable business behaviours in recent years (Claro, Laban Neto, & De Oliveira Claro, 2013). This trend has been identified by different researchers, who recognise that sustainability is a key factor for consumers (Belz & Schmidt-Riediger, 2010) and where there is a perceived demand for brands concerning sustainability (Charter, Peattie, Ottman, & Polonsky, 2006) that has grown because of recent global changes.

Moreover, some authors have investigated CSR and sustainability in the luxury sector to better understand the connection between theory and practice (Amatulli et al., 2017; Gardetti, 2017). Furthermore, luxury brands face greater pressure to make their businesses more sustainable (Li & Leonas, 2019). Therefore, some academics have detected that luxury brands react favourably to sustainability trends by adopting solutions in accordance with consumer expectations (Cervellon, 2013) and their customers' growing demands (Khan & Ahmed, 2017). Consequently, luxury companies must be more sustainable (Thomas, 2018).

In general, luxury is associated with sustainability because luxury firms include sustainable solutions in their value chain to respond to

global demands affecting the fashion industry (Thorisdottir & Johannsdottir, 2020). All of this is integrated into the CSR/sustainability reports, where these firms communicate their annual progress and impacts, thus increasing their transparency in the results related to sustainability. In addition, these firms report on the medium- and long-term business strategies linked to sustainability, following global trends (McKinsey, 2021).

Similar to governments and companies internationally, the luxury fashion industry also follows the recommendations of the 2030 Agenda to promote sustainable economic growth while respecting the environment and society. Hence, it has taken on global challenges summed up in the 17 Sustainable Development Goals (SDGs): SDG 1, no poverty; SDG 2, zero hunger; SDG 3, good health and well-being; SDG 4, quality education; SDG 5, gender equality; SDG 6, safe drinking water and sanitation; SDG 7, clean and affordable energy; SDG 8, decent work and economic growth; SDG 9, industry, innovation and infrastructure; SDG 10, reducing inequality; SDG 11, sustainable cities and communities; SDG 12, responsible consumption and production; SDG 13, climate action; SDG 14, life under water; SDG 15, life on land; SDG 16, peace and justice strong institutions; and SDG 17, partnerships to achieve the goal (UN, 2015).

Therefore, companies are aligned with global institutions' proposals to promote sustainable development. This situation has accelerated because of the COVID-19 pandemic. The fashion industry is also trying to respond to these challenges through the circular economy (SDG 8 and SDG 12), next-generation materials (SDGs 9, 11, and 12), responsible consumption, sustainable production (SDGs 3, 6, 7, 8, 9, and 12), and transparency (SDGs 4, 8, 10, 12, and 16) (Manifiesto, 2019).

Finally, all of these actions are included in annual CSR/Sustainability reports, in which these firms associate their impacts with various SDGs, providing information that allows in-depth knowledge of their efficiency linked to the sustainable practises of their business strategies, focusing on environmental impact reduction and the acceleration of its business transformation towards sustainability (Fashion, 2020).

2.2. Why luxury fashion brands and their approaches to carbon footprint are important and can lead to new climate change management results

The increase in carbon dioxide (CO₂) and other GHG emissions worldwide has had a direct impact on climate change and negative environmental consequences, mainly due to the burning of fossil fuels (Wadera & Kaur, 2020). Initiatives at the international level, such as the recent COP26 (United Nations, 2021) in November 2021 or the 2015 Paris Agreement (United Nations, 2016), try to agree on common objectives to fight climate change and its negative consequences for the planet and for people. However, an increasing number of countries are implementing stricter regulations to protect the planet (Rukhaya et al., 2021).

The fashion industry is regarded as a major contributor to GHG emissions, not only because of their production and transportation (Rukhaya et al., 2021) but also because of the emissions produced when garments are incinerated to protect the brand image of some companies, to avoid selling such products in secondary markets or in other countries at a lower cost (Bae, 2019). In this regard, according to McKinsey & Company data (Berg et al., 2020), the fashion industry was responsible for 4 % of global emissions (2.1 billion metric tons of GHG) in 2018, although other studies put the figure closer to 10 % (Brewer, 2019).

Furthermore, this industry is also considered one of the most polluting industries because of the production of fabrics and the waste that continues to be generated when synthetic garments are washed, in the form of microplastics that escape all filters and reach the sea (Browne et al., 2011; Henry, Laitala, & Klepp, 2019; Pirc, Vidmar, Mozar, & Kržan, 2016; Rukhaya et al., 2021). Intensive cultivation of raw materials, such as cotton, requires large amounts of water, which worsens land quality and causes major droughts (Chapagain, Hoekstra, Savenije, & Gautam, 2006; Rukhaya et al., 2021).

The vertical integration of processes in their chain value, the use of eco-friendly materials, research into environmentally friendly materials, increasing the life of products, or betting on the second-hand or rental market are some of the measures that the major luxury fashion brand holding companies, such as Chanel, Kering, or LVMH, are working on for sustainable production (Willersdorf et al., 2020). Other measures proposed for the entire fashion industry include ‘reducing emissions from upstream operations, reducing emissions from brands’ own operations, and encouraging sustainable consumer behaviour’ (Berg et al., 2020).

Ample literature shows that luxury fashion brands lead the response to environmental demands in the fashion industry (Rukhaya et al., 2021) (Osburg et al., 2021). Sustainability is a key area in developing luxury fashion brands (Wadera & Kaur, 2020). Moreover, research into new materials and processes, as well as the measurement of their carbon footprint, are critical axes for responding to societal challenges (Wadera & Kaur, 2020; Willersdorf et al., 2020), something that the fashion industry is attempting to promote through agreements such as Pact (2020).

New generations of luxury consumers and those with more economic resources demand sustainable and environmentally friendly products (Bae, 2019; Rukhaya et al., 2021). Consumer pressure on the luxury fashion industry has accelerated the incorporation of sustainable measures (Osburg et al., 2021; Rukhaya et al., 2021) in three key areas related to the environment/planet, society/people, and profit (Bae, 2019; Wadera & Kaur, 2020). Movements such as ‘slow fashion’ are gaining more popularity every day because they promote buying fewer, higher-quality clothes and wearing them longer (Ozdamar-Ertekin & Atik, 2015). In addition, the circular economy, which promotes giving clothes a second life by recycling, donating, or selling them, is gaining traction (McKinsey, 2021; Olatubosun, Charles, & Omoyele, 2021). In general, the techniques used by luxury brands to fulfil this approach are published in their sustainability reports, which will be the subject of further studies described in the following. However, some luxury firms still do not publish this information about their sustainable activities.

The preceding is evidence of several related and concurrent trends in the research field: (i) the impact of climate change is focusing on specific metrics that enable accuracy of such impact, the most important of which are CO₂ emissions; and (ii) the fashion industry places special emphasis on such metrics, with the luxury sector being a key player. With this in mind, we can comprehend the existence of a field of investigation in fashion industry’s response to the climate change challenge, especially when it comes to the use of specific metrics.

3. Methodology

Initially, the work presented in this paper is based on different sets of data to understand how companies measure their environmental and economic impacts considering aspects such as (i) analysis of the carbon footprint of three companies using the IPCC method (Downie & Stubbs, 2013; Hertwich & Wood, 2018)¹; (ii) their economic results, as measured by revenue; and (iii) their market share. The IPCC method establishes three scopes to measure this (BHP, 2020; Report, 2022):

- (a) Scope 1 measures the CO₂ emissions from the fugitive.
- (b) Scope 2 measures purchased electricity, heat, and steam.
- (c) Scope 3 measures purchased goods and services, business travel, employee commuting, waste disposal, use of products, transportation, and distribution (upstream and downstream), investments and lease assets, and franchises.

¹ An alternative would be to use more complex SFDR indicators (Ferriani, 2022), yet such information is used only for investments, such as funds (not economic activity itself or conglomerates information), and therefore not published by conglomerates like those presented in this study.

In this regard, it has to be considered that Scope 3 entails a measurement challenge, given that most of the scope’s concepts are out of a company’s control. For example, a company cannot control the emissions generated by an investment it purchases because the investment generated such emissions prior to the purchase and thus leaves a trace that the purchasing entity cannot control. This is because of the limitation that this study reaches scopes 1 and 2, but not scope 3.²

The carbon footprint and economic results entail a company’s cost, meaning it represents the use of resources that a company must use and, obviously, pay for. For example, when a company pays for transport, such pollutants are measured in CO₂ emissions; hence, carbon footprint is the consequence of an activity that generates costs. Therefore, the hypothesis of this study focuses on validating whether

H₁. *Carbon footprint is related to the economic results in major luxury conglomerates.*

This study used two methods to analyse the hypothesis described earlier: graph analysis and correlation analysis. Graph analysis has enabled ‘(...) a key technology for analysing and presenting climate simulations and observations as well as related social and ecological data’ (Nocke, Sterzel, Böttinger, & Wrobel, 2008). Moreover, correlation analysis enables the study of relations between sets of data since ‘(...) a correlation analysis becomes useful to explore the association between independent and dependent variables’ (Senthilnathan, 2019, p.8). Because of the strong concentration of brands in the sector in only three large conglomerates, the choice of these two techniques allowed this study to undergo a visual and relative analysis, which other methods (i. e., regression) would not have allowed because more complexity would have required more data, which is not available.

The sample is composed of studies of CO₂ emissions, revenue, and market share of LVMH from 2013 to 2019 and of Chanel from 2017 to 2019. It would be optimal to obtain data for an entire decade (from 2011 to 2019), and it must be noted that the analysis in this study is influenced by the availability of comparable data. Chanel was a fully closed conglomerate in 2016–2017 onwards, so data on the environmental effort of this player in the market are not available prior to that. Nevertheless, one of the objectives of our analysis (LVMH) has been publishing information regularly for the desired period and therefore encompasses a larger part of the work thereof, as well as the conclusions obtained.

The reason for using data from only two companies (LVMH and Chanel) is that both are European, meaning that they are all subject to common regulations. Additionally, they both issue public information on carbon footprints and CO₂ emissions. Finally, they belong to the same industry and are thus comparable in nature, which enables our work. Even though it would be very interesting to include additional companies in our data set, the following must be taken into account: The luxury brands sector is highly concentrated (Deloitte, 2020), implying that by utilising these companies in this work, we are reaching not only a few players in the sector but also a large stake. Furthermore, these three companies entail a larger part of the brands that generate economic activity (Deloitte, 2020): LVMH owns 75 brands, and Chanel owns 4 brands. Therefore, even though it would appear as if the use of the aforementioned sets of data was limited, it amounts to almost 80 brands in the luxury fashion sector.

Although Kering is one of the world’s leading luxury holding companies and a pioneer in implementing sustainability and environmental policies, it was excluded from the analysis because the company does not publish data on CO₂ emissions using the IPCC method and the three scopes of emissions. Kering created a unique method to publish its CO₂ emissions or any other environmental impact data, which is referred to as the EP&L Index. Based on this method, ‘The EP&L measures carbon emissions, water consumption, air and water pollution, land use, and

² An additional limitation is that not all companies under study publish data on scope 3, such as Chanel.

waste production along the entire supply chain, thereby making the various environmental impacts of the Group's activities visible, quantifiable, and comparable. These impacts are then converted into monetary values to quantify the use of natural resources. Kering can thus use the EP&L to guide its sustainability strategy, improve its processes and supply sources, and choose the best-adapted technologies' (Kering, 2022b). Therefore, Kering does not publish information on CO₂ emissions under the IPCC method and range of scopes, whereas it publishes its environmental impact information in monetary terms, the conversion of which is only known by Kering.

4. Data analysis

4.1. The case for LVMH

The three sets of data that comprise the basis of this work, as stated in the methodology section, are (i) carbon footprint, as measured by the IPCC method; (ii) company results, as measured by revenue; and (iii) market share, in percentage.

The carbon footprint is described in detail by the LVMH in its regular environmental reports.³ It is commonly measured in CO₂ tons emitted into the atmosphere, as shown in Table 1.

Table 1 depicts LVMH's CO₂ emissions from 2013 to 2019, beginning at 307 000 tons and steadily increasing until 2016, when it reaches 385 000 tons. It then decreased in 2017 to 379 000 tons and remained at a similar level until 2019, when it was lower (363 000 tons).

Therefore, we can clearly differentiate between two periods: from 2013 to 2016, where we see a constant growth, and from 2017 to 2019, where we see a clear stagnation.

In addition, the work methodology in this study includes the analysis of revenue and market share for each of the companies in our study, as displayed in Table 2.

Table 2 shows the data for revenue and market share for LVMH for the same period as described in the information on CO₂ emissions: 2013–2019.⁴ Revenue shows a clear and continuous growth trend, starting at US\$21 billion in 2013 and ending at US\$37 billion in 2019.

However, regarding market share, the available data show two different trends: from 2013 to 2016, there is a slight yearly growth from 10,16 % to 10,81 %, whereas growth from 2017 to 2019 saw higher rates, ranging from over 11 % to 13,33 %.

In short, both data on CO₂ emissions and economic results (as in revenue and market share) show a clear breaking point in 2017, when CO₂ emissions stagnate, whereas market share increases at a higher rate. These results are analysed in detail in the following section.

4.2. The case for Chanel

Intending to follow the same method as previously described for LVMH, searching therefore for a proper benchmark, we have had access to the following data on CO₂ emission by Chanel (see Table 3):

Table 3 shows the CO₂ emissions by Chanel from 2017 to 2019 for scopes 1 and 2, ranging from 44 000 to 49 000 tons per year, as provided by the company itself. This information proves the relevant growth in emissions yearly.

The range of the data provided by Chanel was much shorter than that

³ LVMH's environmental reports are publicly accessible via its website (<https://www.lvmh.com/news-documents/>).

⁴ This information has been obtained from Deloitte's *Global Powers of Luxury Goods* reports for the period 2013–2019. The 2018 data are not published by Deloitte, so they have been calculated upon growth reported by Deloitte in its 2019 Report. Revenue has been obtained from data on *Luxury goods* sales, and market share has been calculated as the fraction of *Luxury goods sales* for each company and the total for all Top 100, understood as a representation of the total sector.

provided by LVMH, as described. This is because Chanel is a conglomerate only since 2017, and therefore, has only been comparable to LVMH since that year. However, although the period of analysis is limited, it is relevant when compared to the revenue and market share data for the company, as shown in Table 4.⁵

Table 4 shows how Chanel's revenue from luxury goods sales increased from US\$9,6 billion in 2017 to US\$12,2 billion in 2018, representing a relevant average growth of 12,9%. Sales growth is considered high once it exceeds the double-digit threshold, so Chanel's revenue experienced significant growth during the reference period (in contrast to LVMH's stagnation during the same period).

Regarding market share, 2017 showed a stake of 3,9%, which increased to 4,37 % in 2019. In this case, even though market share grew, this growth was attenuated in comparison to the revenue.

5. Results

5.1. Results for LVMH

Table 5 shows the matrix results based on the methodology described in this paper for LVMH.

The results in Table 5 can be separated into two periods: 2013–2016 (4 years) and 2017–2019 (3 years). For the period of 2013–2016, we can see a constant growth in market share and in CO₂ emissions. As previously stated, this follows the logic of increasing emissions with increasing sales. However, when analysing the 2017–2019 period, we can see that CO₂ emissions stagnate at around 380 000 tons, whereas market share increases at a high level. This means that LVMH managed to produce more and therefore obtain a larger part of the market, without polluting more. Therefore, LVMH reached a level of efficiency when reaching the 380 000 tons of CO₂ emissions.

It is important to highlight that the sustainability reports at hand, as utilised to obtain the data set forth in the tables, show that LVMH has made a strong effort to orient its environment towards the 2030 agenda for the period starting 2017–2018. Starting in 2017–2018, the conglomerate focused on a wide range of actions, including 'working on increasingly stringent standards', 'participating in major international programmes', 'reducing energy consumption', 'optimising the carbon footprint', 'standardising eco-design', and/or 'designing long-lasting products', all of which are encompassed in the SDGs described in previous sections and are new for the second period in this paper.

It is no coincidence that the strategy oriented to actions related to SDGs, which reflects managerial changes in the conglomerate, meets a moment in time when the environmental results, as measured by CO₂ emissions, have stagnated, yet does not compromise the conglomerate's economic results but rather coincides with an increase in sales of luxury goods and market share.

5.2. Results for Chanel

Following the presentation of LVMH results, Chanel's data are presented in Table 6.

Table 6 shows Chanel's relationship between market share, which is directly proportional: a slight increase in market share mirrors a slight increase in CO₂ emissions. However, the data seem to be concentrated in the same area of the matrix with no clear evolution.

Therefore, we can observe that Chanel increases its pollution when its market share increases, which follows the logic set above. Stagnation was not observed in the data.

⁵ The information displayed in this Table has been obtained and calculated upon the same sources and criteria detailed in Footnote 4.

Table 1LVMH CO₂ emissions for scopes 1 and 2 (tons).

2013	2014	2015	2016	2017	2018	2019
307.552,00	324.079,00	344.336,00	385.629,00	379.312,00	384.123,00	363.960,00

Source: Personal elaboration based on information published by LVMH.

Table 2

Revenue and Market share by LVMH (US\$ million).

	2013	2014	2015	2016	2017	2018	2019
Revenue	21.761,00	23.297,00	22.431,00	23.447,00	27.995,00	32.078,77	37.468,00
Market Share	10,16 %	10,49 %	10,58 %	10,81 %	11,33 %	12,06 %	13,33 %

Source: Personal elaboration based on information published by Deloitte.

Table 3CO₂ emissions by Chanel for scopes 1 and 2 (tons).

2017	2018	2019
44.000,00	41.765,00	49.849,00

Source: Personal elaboration based on information published by Chanel.

Table 4

Revenue and market share by Chanel (US\$ million).

	2017	2018	2019
Revenue	9.623,00	10.765,79	12.273,00
Market Share	3,90 %	4,05 %	4,37 %

Source: Personal elaboration based on information published by Deloitte.

5.3. LVMH vs Chanel

Finally, the analysis showed different results when studying the case of each company separately: LVMH and Chanel. The following table shows a matrix comparing market share against CO₂ emissions for both the LVMH and Chanel conglomerates, establishing the relationship between both variables for the luxury sector, as described in Table 7.

The horizontal axis represents CO₂ emissions, as calculated using the previously mentioned methodology. The results of such methodology show that Chanel's CO₂ emissions are in the lower part of the sector (from 44 000 to 49 000 tons). When such data are compared to the conglomerate's market share, we can see that it is also in the lower range of the sector (bordering 4 %).

With regard to LVMH, we see that the level of emissions for this conglomerate is much higher, but it also meets a higher market share (a stake somewhere between 10 % and 13 %).

Accordingly, we see a clear, direct, and proportional relationship between market share and CO₂ emissions: the higher the share, the higher the emissions. This can be observed more clearly by establishing a linear relationship or trend graph between the two variables, as shown in Table 8.

Table 8 shows a clear growing trend in the matrix of our results (see the dotted line). This is also proven by the fact that the coefficient of the two variables⁶ correlation is 0,989.⁷ This indicates a robust correlation between market share and CO₂ emissions: every time one variable experiments with a variation, so does the other one, and vice versa.

These results are logical because the increase in market share is caused mainly by the rise in product sales. The more products a company sells, the higher the industrial effort in all senses, including

⁶ Ratio between the covariance of two variables and the product of their standard deviations. The closer to 1 (in absolute value), the more related two variables are.

⁷ Upon the data in Tables 1–4 as displayed in previous sections.

environmental effort such as CO₂ emissions.

6. Discussion, conclusions, and implications

Luxury brands have always responded to major societal challenges; hence, luxury today has a strong environmental component with a focus on sustainability and climate change (Bae, 2019; Osburg et al., 2021). Given the impact of the fashion industry on the environment, luxury fashion brands are responsible for transforming the industry in a way that ensures its survival and implementation of the highest market standards. This means that luxury firms are becoming more sustainable (Thomas, 2018), providing many sustainable solutions in their value chain (Thorisdottir & Johannsdottir, 2020), which should also be more efficient from an environmental and economic perspective.

According to LVMH's sustainability reports, its action plan took a strong orientation towards the 2030 Agenda. Specifically, starting in 2017–2018, the conglomerate has focused on a broad range of activities such as 'working on increasingly stringent standards', 'participating in major international programmes', 'reducing energy consumption', 'optimising the carbon footprint', 'standardising eco-design', and/or 'designing long-lasting products'.

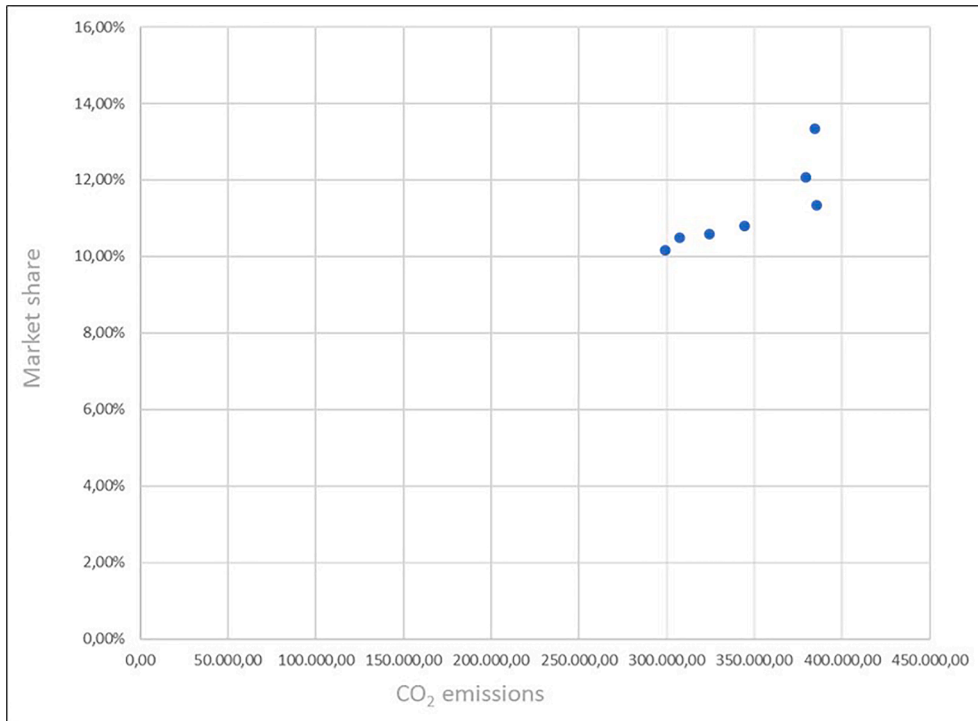
The above actions (i) are clearly oriented towards efficiency because standardisation and common programmes along the industrial scale allow for more efficient resource use; and (ii) are clearly oriented to managerial concepts because SDG actions like 'working on increasingly stringent standards' and 'standardising eco-design' are clearly management-oriented. It stands to reason that larger companies, with larger audiences, clients, suppliers, and markets, will find it easier to carry out this effort.

As stated earlier in this work, there has not yet been a deep dive into research on how luxury fashion brands are catching up on sustainability while also managing efficiency (Diallo et al., 2021; Osburg et al., 2021; Rukhaya et al., 2021). Therefore, this study serves as an initial approach to the subject, and further research could enhance the preliminary conclusions on the economy of scale.

The hypothesis of this study (i.e., *carbon footprint is related to economic results in major luxury conglomerates*) can be validated because a direct relationship exists between market share and CO₂ emissions, as demonstrated by correlation methods. This means that the more a conglomerate manages to encompass it, the more it pollutes. However, we have found that when the market share reaches a certain volume (around 11 % and 13 %), CO₂ emissions seem to stagnate. Therefore, when a certain level is reached, the relationship stops being proportional and becomes less than proportional, meaning that pollution grows less than production, thus generating efficiencies. This conclusion is relevant in economic and CSR terms.

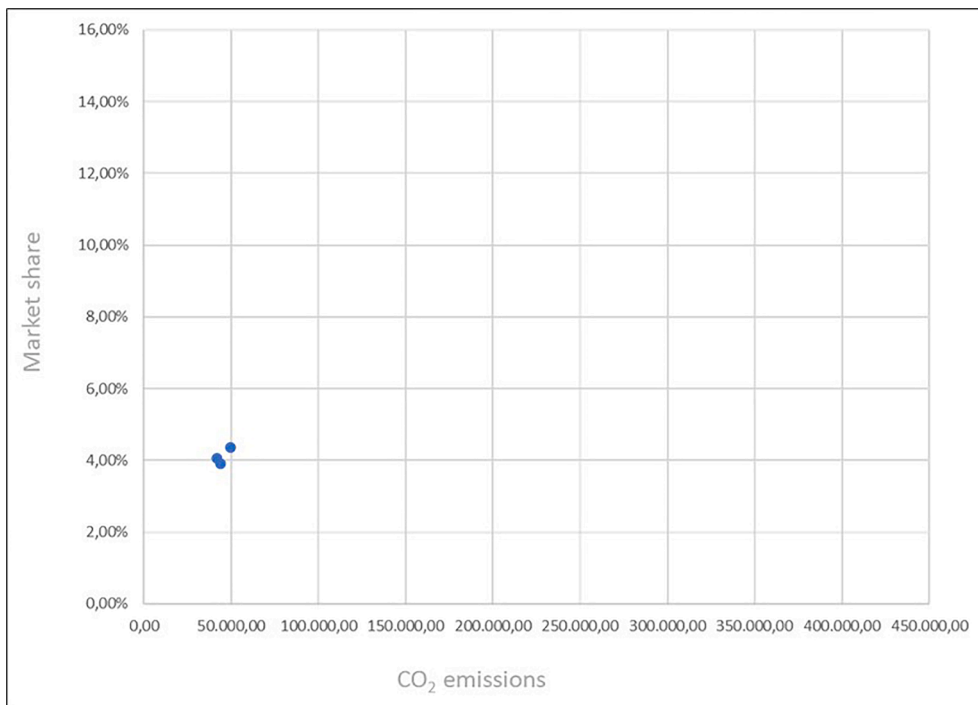
For many years, economic studies have focused on the economies of scale, particularly in terms of resource exploitation and profit. However, the preceding conclusion leads to the understanding that an economy of scale of environmental effort may exist where investment in

Table 5
Relationship matrix: market share versus CO₂ emissions (LVMH).



Source: Personal elaboration based on Deloitte and LVMH.

Table 6
Relationship matrix: Market share versus CO₂ emissions (Chanel).



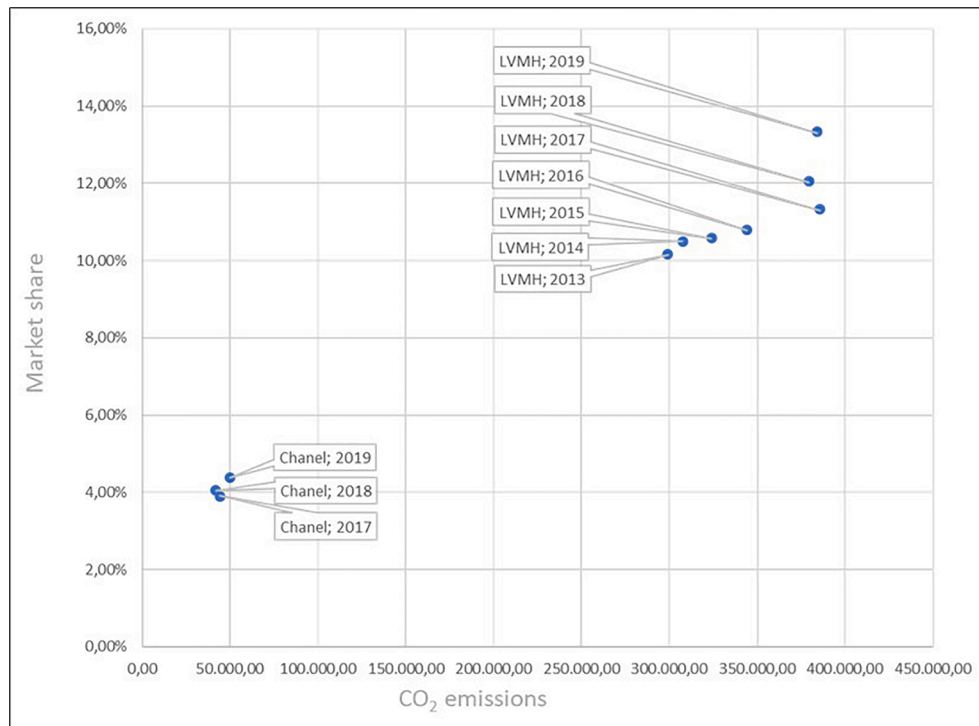
Source: Personal elaboration based on Deloitte and Chanel.

environmental measures, such as CSR, may reach a point where more production and market share does not imply more pollution.

This concept entails decreasing pollution yields. Therefore, the larger the conglomerate, the less pollution per product sold. Further discussion

should address whether this means that a luxury sector with fewer manufacturers, each with a larger share of the sector, could lead to a more efficient environmental production framework. This means that larger companies are more environmentally friendly than are small

Table 7
Relationship matrix: Market share versus CO₂ emissions — data matrix (LVMH and Chanel).



Source: Personal elaboration based on Deloitte, Chanel, and LVMH.

manufacturers.

In terms of CSR, the conclusion reached regarding CO₂ emissions stagnation is relevant in the context of the 17 SDGs established in the 2030 Agenda approved by the United Nations, specifically in the SDGs described in this study.

The conglomerate that has reached efficiency in terms of CO₂ emissions owing to its large market share, LVMH, has also established an explicit strategy for actions oriented towards SDGs.

Further research could lead to the development of clearer frameworks or managerial actions that allow for the possibility of achieving the economies of scale defined in this paper. SDG-based actions undertaken by LVMH since 2017 will be analysed as a potential source of the economies of scale described in this study. In this regard, it is important to highlight that the data shown in this study are not influenced by price, as it is based on the market share of a single sector where, even though not identical, all prices from different competitors are understood to be comparable (otherwise, they would not belong to the same sector). Additionally, culture or location should be the source of the aforementioned economies of scale that would be embedded in the actions taken by the conglomerates or the identical legislation. In this regard, the two conglomerates in this study were specifically chosen because they are European and thus subject to the same culture and legislation. Therefore, legislation, which is common to all players in this study, can be understood as a control variable that conditions all players equally for future analyses.

Moreover, a discussion is needed to understand how other emissions impact the conclusions of this study. For example, larger conglomerates concentrate their production in larger work centres to which resources, products, and employees must be transported, leading to larger emissions than smaller businesses. Therefore, do larger companies have a more polluting transportation impact? Meanwhile, what is the pollution generated by the vast and complex transportation network that must serve diverse groups or small businesses? Finally, are small producers capable of investing in standardisation or are they limited by their lesser

access to financial resources? Further work is needed by investigators in this field. It is clear that the leader (LVMH) has managed to obtain higher shares in the market without increasing pollution.

Author contributors

CR-P, MF and BL were involved in the conceptualization of the project. MF was involved in the acquisition of data and analysis. CR-P, MF and BL were involved in the interpretation of the data. All authors were involved in drafting and revising the work for intellectual content and approved the manuscript for publication.

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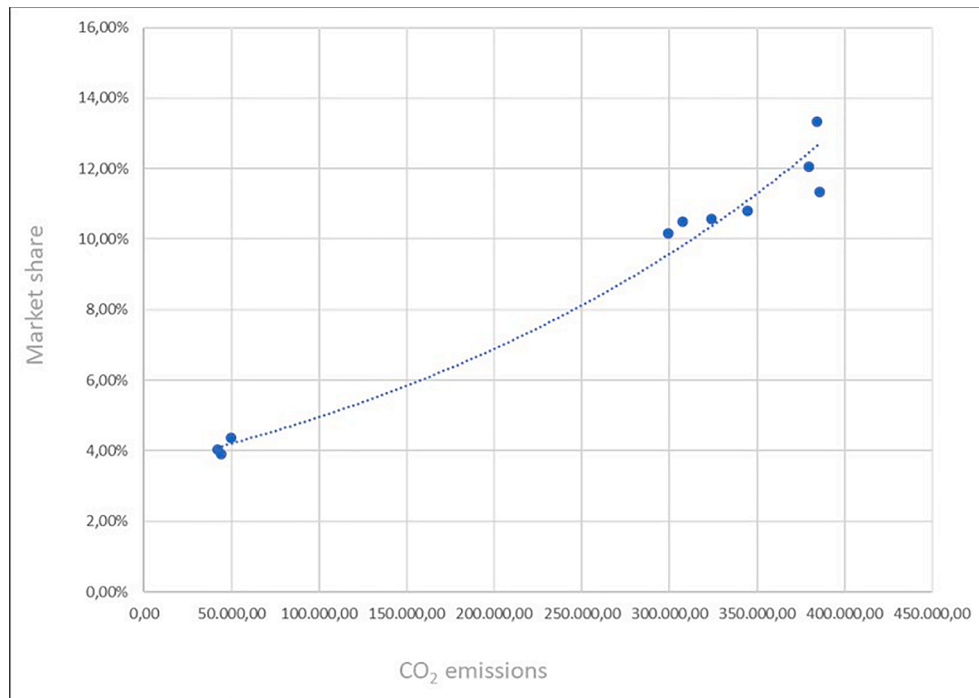
CRediT authorship contribution statement

Belén López: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Conceptualization. **Celia Rangel-Pérez:** Writing – review & editing, Writing – original draft, Resources, Investigation, Conceptualization. **Manuel Fernández:** Visualization, Validation, Software, Methodology, Formal analysis.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Table 8

Relationship matrix: Market share versus CO₂ emissions — graphic relationship (LVMH and Chanel).

Source: Personal elaboration based on Deloitte, Chanel, and LVMH.

Data availability

Data will be made available on request.

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